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A Group Report

WE suppose about one in a thousand of our readers knows what P.E.P. is. For the benefit of the remainder we may say that the letters stand for "Political and Economic Planning"—a group of men and women, industrial, professional, governmental and public, who, while indisposed to reveal their identity, are devoting serious thought and attention to the preparation of proposals and putting them forward for consideration on their merits. P.E.P. has an Electricity Group, and it has just issued "Broadsheet No. 65," devoted to the subject of Electricity Distribution—"the next phase." We are informed that it is the result of many months' study of the subject; it sets forth in some detail what are regarded as the principles upon which the new distribution developments should be carried out.

Whatever merit the proposals may possess, we will not disguise our regret that the time for their publication should have been so ill-chosen. The McGowan Distribution Committee has been investigating the whole subject very exhaustively for some time past, and the nature of its report and recommendations should be divulged shortly. But, apart from that, we are disinclined to review any anonymous document seriously, because, however much we may be assured that the group includes men of eminence, authority and experience in the electricity supply world, the absence of actual identities excites inquiry concerning their truly representative character and doubt as to whether all classes of interests likely to be affected by change have had a say in the matter.

When a crop of proposals came before us all a year or so ago for reorganisation, nationalisation and so forth, we could evaluate them with some degree of certainty because we knew their origin. We confess, however, to only a mild interest in deliberations by a group of individuals whose identity is not revealed.

Having said this, and disclaiming any desire to restrain legitimate examination of a great problem, which should have the most open and free discussion possible, we will content ourselves with a statement of the three lines of approach to the distribution problem on which the Electricity Group considers immediate action should be taken.

Legislation is held to be necessary to remove existing anomalies and defects and to co-ordinate and simplify past Acts. A committee of investigation is suggested to assess the relative efficiencies of undertakings, as the essential preliminary to any reorganisation scheme; and, finally, after a close study of existing organisations, it is recommended that a Central Development Authority should be "created" with powers over finance, publicity and propaganda, standardising, testing and approving of consumers' equipment, prices of manufacturers' appliances to supply undertakings, economic research and statistics —"and so forth."

This proposed new authority is thought of as complementary to both the Central Electricity Board and the Electricity Commission. Many of our readers hold that we already have quite enough, if not too many, authorities controlling electricity supply.

A Diamond Jubilee

WE are reminded by some interesting literature that has just reached us that "sixty years have gone since two men began work in a simple shop at Charlton" starting a business which was destined to enjoy a world-wide reputation electrically and to be bigger and more prosperous than ever in the year nineteen-thirty-six. The diamond jubilee of Johnson & Phillips, Ltd., is fittingly marked by the publication of a brochure in which the story of the past is told by pen and picture. The more mature amongst our readers will linger longest over the early photographic group of the company and its employés, in which Walter Claude Johnson and Samuel Phillips, the founders in 1875, appear, also the late Mr. John Macgregor. Other pictures show the first shop and an aerial view of the factories and offices as they exist to-day. The telegraph engineering activities, so extensive in the first quarter of a century, the cable and

cable accessories business, the production of switchgear and instruments, transformers, overhead lines, and, last of all, electric water-heating appliances, combine to impress one with facility for adaptation to the needs of changing times. By means of maps the extent of the J. & P. overseas organisation is indicated. A separate booklet was recently issued to shareholders telling the story of the company's manufactures. It is interesting to recall here that the first Johnson & Phillips announcement published in the ELECTRICAL REVIEW appeared fifty-seven years ago—in our issue of October 15th, 1878.

Dual-purpose Steam

IN view of the small number of heat units expended in raising the pressure of steam from a low to a high figure, compared with those required to evaporate the water, due to the latent heat of steam, it is reasonable to expect considerable economies to attend a practical application of the principle. Thus, in works where a large quantity of low-pressure steam is needed as well as electricity for motive power, only the additional B.th.u. necessitated by a suitable increase in boiler pressure need be debited to electrical generation. The deduction that electricity so produced will cost little is not necessarily correct, as the technical gain is often more than counterbalanced by heavy capital charges. In this issue Mr. R. G. Devey discusses the conditions in which the installation of mixed-pressure, back-pressure or low-pressure generating sets is economically sound, as against purchased power or local generation by all-condensing units. The decision depends upon so many variable factors, including the manufacturing aspects of the user, that each case must be considered on its merits.

Certified Meters

IN the address which he delivered last Friday as chairman of the I.E.E. Meter and Instrument Section, Mr. O. Howarth brought the issue of individual meter certification (recently raised in East Ham) on to the practical plane. His suggestion is that the inspector, after satisfying himself that the methods and equipment of an undertaking's testing department are suitable, shall consider all meters to be certified provided the test records are produced on demand. The inspector would make calls without notice to ensure the maintenance of an adequate standard. Undertakings without approved testing departments could have their meters tested by an approved body. Mr. Howarth's scheme should protect the public interest at little additional expense.

Fair Trading

OUR recent references to the ironmongers' claim to be represented on the Electrical Fair Trading Council may have led our readers to wonder how that Council's affairs are progressing. Mr. F. A. Rogers, the secretary, tells us that the attention of the Council during the last few months has been directed towards the preparation of schedules and other intricate matters necessary to the completion of the Policy. A second document has recently been drawn up setting out the powers, functions and general rules of the Council, and it is expected that this will be coupled with the Policy when it is ready for issue. There is every indication that an important announcement regarding the scheme will be made shortly. In the meantime, the adherence of the supply authorities has not yet been secured.

This Year's B.I.F.

JUDGING from the list of Birmingham exhibitors published on page 60, the decision of the organisers of the British Industries Fair to revert to their former policy of running both the London and Castle Bromwich sections simultaneously in February is not disapproved of by manufacturers of electrical and allied equipment, at any rate. True there are certain notable absentees from this year's list, in particular several makers of refrigerators, but the large number of new exhibitors brings the total to well above that for 1935, and has necessitated still further extension of the accommodation available at Birmingham. A number of manufacturers have stands in both sections, and the change of date appears to be responsible for a marked tendency to transfer from London to Castle Bromwich. In view of improved trade conditions, there is every reason to hope that the 1936 Fair will be a greater success than ever.

Regulations in New Zealand

LAST week we referred to discussions regarding possible modifications in the Commissioners' Supply Regulations as applicable to installations connected before January 15th, 1934. The British Standards Institution has a limited number of copies of the New Zealand Electrical Supply Regulations (and also of the N.Z. Wiring Regulations) which came into force last September. Comparing the points mentioned in our issue of January 3rd, we find that the maximum voltage permitted on a consumer's premises is 230 V when the connected load does not exceed 2 kW, except for motors and heating for industrial purposes. The tolerated variation of voltage is 5 per cent. and of frequency 1½ per cent.—both above and below the declared values. A resistance connected in parallel with a breaker earthing a d.c. neutral (for protecting the ammeter only) must not exceed 10 ohms. Conditions are in many ways dissimilar to those prevailing in Great Britain, but a study of the New Zealand Regulations may be helpful in considering amendments to our own.

The Training of Canvassers

MEMBERS of E.D.A. are urged to make it possible for at least one member of their experienced sales staffs to attend the schools for training canvassers which have been organised for this month and next at London (Savoy Hill), Bristol, Birmingham, Manchester, Leeds and Newcastle. They will act as officers-in-charge, and will follow the instruction given to their trainees, thus better qualifying themselves to make the best use of the experience so gained, when their assistants return to apply the teaching in their daily calling. The system and course of training, the dates and periods of each school are announced in the Association's *Bulletin* for January.

Important Company Registrations

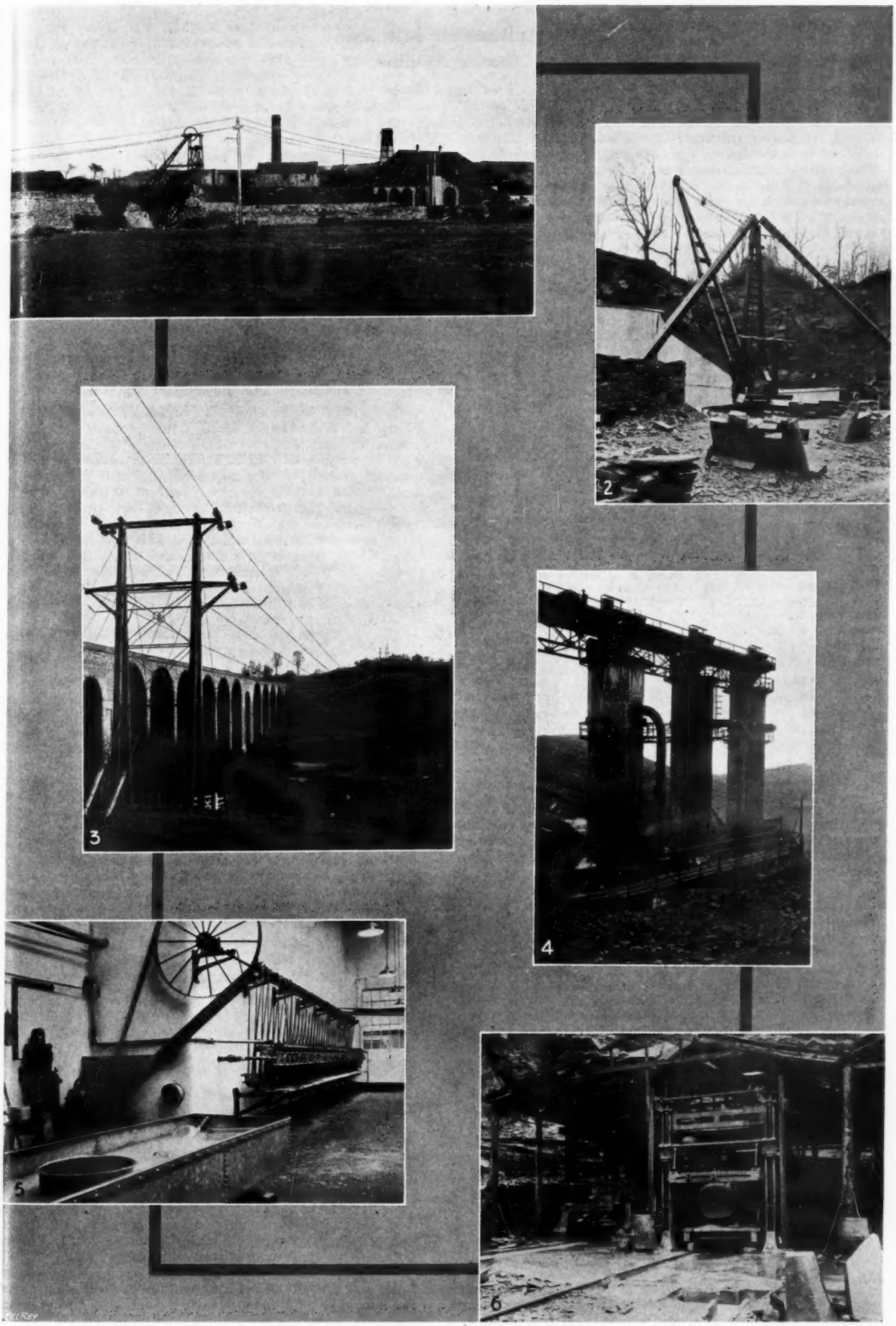
IN our "New Companies Registered" section to-day we record the formation of Elexcel, Ltd., with a capital of £250,000, to take over the domestic appliance department of the Automatic Electric Co., Ltd., whose principal business is the manufacture of telephone and traffic signal equipment. Another noteworthy registration is that of Aeronautical and General Instruments, Ltd., which is to acquire a part of the business of Radio Instruments, Ltd. The directors include Mr. J. Joseph, of Radio Instruments, Ltd., and Mr. W. McClelland, director of W. T. Henley's Telegraph Works Co., Ltd.

A Triumph of the Synthetic

A REMARKABLE tribute to the value of synthetic resin as a substitute for the natural product is contained in the 1934-35 Report of the Indian Trade Commissioner in London. Dealing with the difficulties encountered by the Indian lac and shellac producers, he says:—

> "The consumer's point of view has again to be put on record, for unless his demands can be implemented lac research work will remain largely of academic value. The consumer wants lac products at reasonable prices and of guaranteed purity and quality. That is what the synthetic resin or "shellac substitute" manufacturers can give him, and the Indian producer and manufacturer has either to accept this position of affairs or to face the gradual shrinkage of the trade in a valuable Indian commodity, a commodity which has undoubted technical advantages over its rivals, but is confronted with difficulties only capable of solution at the production end."

The tremendous advance made by the synthetic resin industry during the past few years testifies to the satisfaction which its products have given to the electrical industry as reliable and inexpensive insulation.



Some of the North Somerset Company's Consumers. **(See page 45)**

1. The New Rock Colliery. 2. A crane at the Conygar Quarry. 3. An 11-kV, 1,150-ft. span at Pensford. 4. The Callow Rock lime kilns. 5. A line of sterilisers at the Wilts United Dairies cheese factory. 6. Group-driven sawing machines at Conygar Quarry

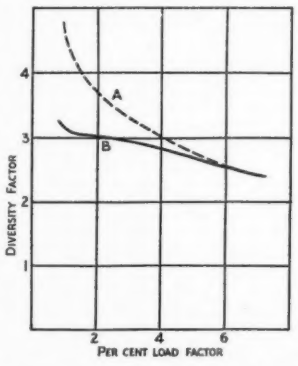
Diversity of Demand.

By G. W. Stubbings, B.Sc., A.M.I.E.E.

Its effect on low load factor supplies

DIVERSITY factor is a ratio which is mainly used to justify supplying consumers at a lower overall rate per kWh than appears equitable according to a scientific system of charging. It is primarily defined in reference to a stipulated group of consumers as the ratio of the sum of the individual maximum demands of these consumers to their resultant maximum load. This definition, at first sight simple and satisfactory, soon raises important questions. What is the time average on which maximum demands are calculated? What is the period to which a diversity factor has reference? Upon what basis are consumers grouped into classes?

Until these more obvious questions have been authoritatively settled, diversity factor is of nebulous significance. It is even more difficult to measure than to define exactly. In one case, that of the supply to a number of sub-stations, diversity can certainly be measured with a fair degree of accuracy. When, however, the diversity of a group of consumers is required, any determination must almost necessarily be based upon measurements made in representative sample cases, and the final result is a statistical average rather than an exact measurement.



Curve A is drawn on the basis that diversity = $1/l^{1/3}$; B is a more probable curve for domestic consumers

The difficulty of measuring diversity factor tends to encourage bias in estimating, with the result that there was, until quite recently, a tendency to beg the question in discussions of tariff problems, and to assume a value of diversity which suited the argument it was desired to establish.

Not long ago an estimated value of ten was put forward as the diversity of cooking loads having an average load factor of five per cent., but present-day estimates, based upon serious attempts to measure diversity, are much more conservative.

Grouping Consumers

In grouping consumers for the purpose of arriving at a class diversity factor, a possible basis is the geographical one, but the result would not have any very definite meaning. Another basis is that of the use of the supply; *e.g.*, for industrial power, domestic or shop lighting.

Some knowledge of diversity factors of classes of this kind are required in the calculation of scientific flat rates applicable to various uses of the supply. Another possible basis of classification is that of load factor, in view of the possibility of an approximate functional relationship existing between load factor and the diversity factor of the consumers whose supplies are taken at this load factor.

This possibility is indicated by the almost self-evident principle that the diversity factor of a group of consumers having a given load factor cannot exceed the reciprocal of such a load factor. This maximum value of diversity can only arise in the imaginary case in which the resultant of a group of consumers' loads is constant. The maximum possible value of the diversity rises as the load factor falls, and this suggests that, as a rule, the diversity of a group of high load-factor consumers will be smaller than that of a lower load-factor group.

This approximate connection between load and diversity factors does not invariably apply. Street lighting, for instance, may be considered to represent the aggregate of a large number of small consumers of moderate load factor. The diversity of this group will, however, approximate very closely to the minimum value of unity.

Proposed Formulæ

Graphs based upon actual tests of the demands of sample consumers have been published, showing this approximate connection between load and diversity factors, and two formulæ, at least, have been proposed. Mr. D. J. Bolton has suggested, as the result of statistical analyses, that in a class of constant load factor, 1, the diversity is given by the expression $1/l^{0.3}$. More recently Mr. F. S. Naylor has given a formula $1/l^{1/3}$, that is based upon tests. These two formulæ are almost identical, but Mr. Naylor admits that his ceases to be accurate when the load factor falls to a figure in the neighbourhood of five per cent.

Now, any formula which purports to give a connection between load and diversity factors, and which breaks down in the neighbourhood indicated, can be said to fail just when it is required in considering the cost of supply to domestic consumers.

In all supply areas there is to be found a large number of consumers whose annual individual load factor does not exceed, and is probably under, five per cent., and it is in reference to such consumers that controversy is keenest as to whether, under a two-part tariff, the overall rate per kWh which they pay is remunerative. It is generally admitted that the now general use of electricity for occasional heating tends to give rise to very small annual load factors. Peak loads of 2½ kW are common; if this demand were taken at a load factor of 100 per cent., the annual consumption would be 21,600 kWh. Now, large numbers of consumers, which impose peak demands of the order mentioned, have an annual consumption of the order of 400 kWh, corresponding to an annual load factor of something like two per cent.

Diversity and Low Load Factors

What is of prime importance in discussing the cost of supplying the low load-factor consumer is the probable correlation between diversity and load factors between ten and two per cent. If we use Mr. Naylor's formula to obtain numerical values of diversity in this region we find that the probable diversity with a load factor of ten per cent. is about 2.1, with five per cent. load factor 2.8, and with two per cent. load factor, 3.7. These numerical values are markedly conservative in comparison with those which used to be put forward on a basis of pure estimation. On the other hand, they show a tendency for the diversity to rise rapidly as the annual load factor varies between five and two per cent. which, considered in reference to domestic loads, probably does not represent the truth.

There is good reason to believe that the diversity from occasional heating is considerably smaller than is given by the hyperbolic formulæ which have been proposed. For instance, let us consider a group of consumers whose annual load factor, due to occasional heating, falls to as low as two per cent. A diversity factor of four means that at the time of their maximum resultant peak only one consumer in four, on an average, is making more than a small demand upon the supply undertaking.

This is so inherently improbable that Mr. Naylor's doubts as to the trustworthiness of his formula for low load factors are fully confirmed, and the need for systematic investigation of the kind of correlation existing between low load factors and associated diversities is indicated. On *a priori* grounds there seems no justification for assuming provisionally that the graph connecting load factor and diversity bends over in the neighbourhood of five per cent. If this be so, it appears highly probable that many low load-factor consumers supplied under the conventional two-part tariffs are far from remunerative.

No Sound Basis

The connection between load factor and diversity is of the nature of what statisticians call a correlation. Because maximum possible diversity is arithmetically connected with load factor, this does not indicate a possibility of discovering a rational formula connecting diversity with factor in the general case.

Such correlation as exists is discovered by statistical research and represents probable average conditions only. It must also be borne in mind that any connection between load factor and diversity must also depend very largely upon the class of consuming device which is most likely to give rise to peak loads. In many private premises this device is the electric fire, and the diversity of low load-factor consumers is liable to be low. If peak loads were caused by electric irons, then the probable diversity would be higher, as the circumstances which determine their use in any particular case are very different from those relating to an electric fire.

Speculations as to the probable connection between load factor and diversity are of little real use in tariff calculations. The only basis for sound argument is one resulting from actual tests. Until further research has been carried out to discover the nature of the correlation between low load factors and diversity, the question of whether the overall rates per kWh paid by a large number of consumers are sound will remain unanswered, and the contention of a well-known supply engineer that low load-factor consumers should pay 4d. per kWh for their heating cannot be effectively challenged.

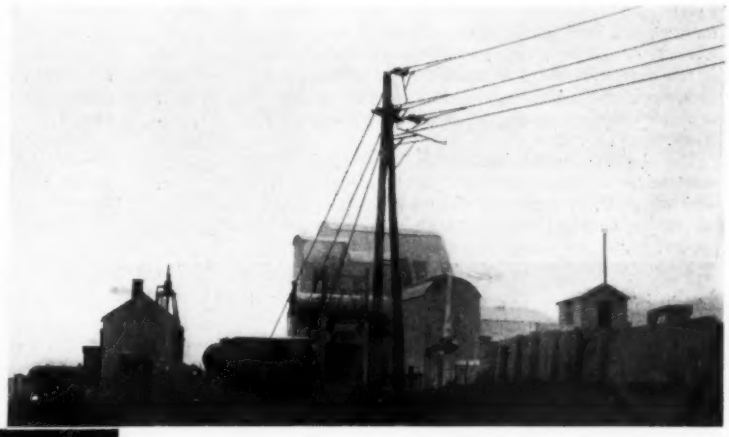
Load Building in North Somerset

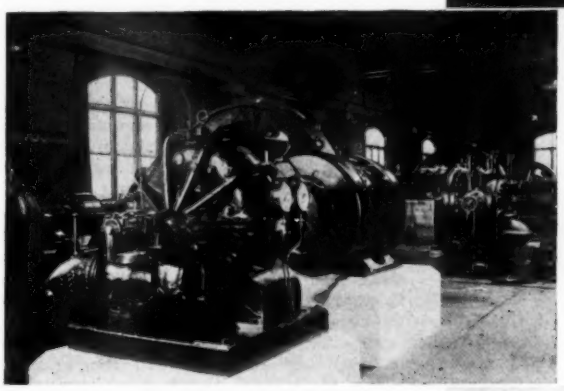
The importance of good load factor

THE load-building policy of the North Somerset Electric Supply Co., Ltd., is described as: first, to endeavour to secure the whole of the industrial load in a district by offering attractive terms for consumption during off-peak periods, particularly in the cases of water heating and pumping, and then to go all out for domestic load under a two-part tariff with the electrification of the small dwelling.

As a result the load factor is now over 40 per cent., quite a good figure for an area of over 600 sq. miles, which may be regarded as mostly rural, and one which is reflected favourably in the terms upon which the company purchases its energy. Most of the electricity distributed is obtained from the Bristol undertaking on a step system, while for the smaller southern section of the area a supply is bought from the Central Electricity Board. The maximum demands last year from Bristol and the grid were 5,800 kW and 1,610 kW respectively. The buying tariff in each case is, of course, two-part. Power is sold on a maximum-demand step basis, varying from £6 per kW to £3 10s. per kW, with a unit step charge from 1d. per kWh to 0.4d. kWh, with the usual coal clause adjustment.

It was explained how pumping to reservoirs, which is the case with the majority of the pumping stations in the area, made it a simple matter to institute schemes for night pumping once the pumping authorities had been won over; the motor contactors are energised under time-switch control. But it was also emphasised that it was the advantage of automatic control with electric driving which gave such a big "pull" in the somewhat severe competition with the oil engine. At the Cheddar pumping station we saw a new 400-h.p. motor-driven pump which in non-flood times deals with 4¼ million gallons of water per day, pumping either to Blagdon Lake (eight miles) or to Barrow Gurney filter beds (16 miles). This pump (W. H. Allen, Sons & Co.), with its B.T.H. motor and Ferguson Pailin liquid starter and oil circuit-breaker, was completed and installed during the 1934 drought within six weeks from placing the order, and it supplements three 260-h.p. oil-engine pumps, the work of two of which it does normally.





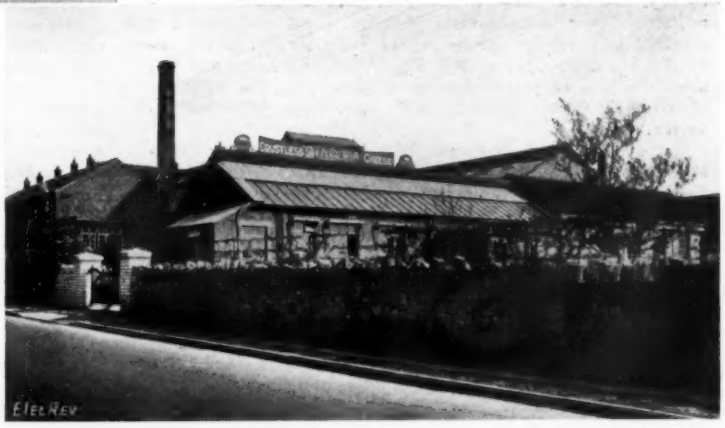
Above: The Black Rock tar-macadam plant, showing the 11-kV terminal pole and kiosk sub-station. Left: A 400-h.p. pumping set at Cheddar—oil sets in background. Below: The cheese factory of Wilts United Dairies, Ltd.

Load-factor improvement efforts, however, are by no means confined to pumping, and one good move in the industrial field is a rebate system which is principally acceptable to the larger quarries, which, as a result, are shut down at four o'clock on winter afternoons. At the Black Rock Quarries we saw how limestone is removed from the hillside by drilling and blasting, and crushed to suitable sizes for road and concrete making, and how part of it is treated in tar-macadam plant. At the rock face three compressed-air drills are served at 100 lb. per sq. in. by two Broom & Wade twin-cylinder compressors driven by 45-h.p. Higgs motors with Allen West oil starters. In a crushing plant which deals with 25 tons of rock per hour a 50-h.p. motor drives the crusher, elevator and screens, and in a similar plant, but without screens, a 90-h.p. drive affords an output of 40 tons per hour.

In the tar macadam section 15 motors totalling about 200 h.p. serve crushing and pulverising equipments, conveyors and elevators, and revolving tar-coating drums. Although the atmosphere in these works is dry and non-corrosive, there is a great deal of dust, yet all the motors are non-protected, but are kept trouble-free by regular nightly blowing out. Mr. Shardlow, the manager, spoke enthusiastically about the convenience of the electric drive and the way in which it could be "tucked away," and he obviously derived some pleasure from the fact that, for this reason, we found it impracticable to take a photograph of one of his drives.

An important operation at the Conygar Quarry is the sawing of Pennant (hard) stone for the production of such articles as kerbstones and window sills. Three sawing machines have a 30-h.p. group drive and they have a normal total cutting output of 6 in. per hour for 15 cwt. simultaneously. Cranes are electrically operated with particular advantage at this quarry, where crushing and drilling also add to its importance as an electricity consumer. This and another quarry are fed by a 100-kVA pole transformer erected some years ago, but nowadays a kiosk sub-station, such as that for the Black Rock Quarries tar-macadam plant, would be erected at the outset. In any case 100-kVA is considered to be the limit for pole-mounting work.

The general policy of the undertaking is to get as near as possible to the quarry with 11,000 V when starting up such a supply scheme, and to plan with an eye on the possibilities of l.p. distribution around the quarry. Indeed, more often than not, an industrial concern of some sort is aimed at as the first move towards a general supply in a district or village, as is evidenced by the general layout of the transmission lines. In this way, and always aiming at keeping l.p. mains as short as possible, the economical distribution area is kept at the maximum. Plenty of mains, low tariffs and intensive selling effort are the three essential requirements for profitable rural electrification laid down by Mr. Ernest Tole, the general manager of the company.



There is a potential quarry in almost every hill in North Somerset, and the undertaking is hoping for big things to mature from the Government's projected road schemes. Correct presentation of the power tariffs often results in a consumer keeping his maximum demand lower than would other-

wise be the case. For instance, at the Callow Rock lime works, a 168 hours per week job, the same men on each shift work on the two major energy-consuming operations alternately. About 500 h.p. serves the quarry, kilns and hydration plant, and about 50 h.p. is used continuously for the producer-gas fired kilns, chiefly for the induced-draught fans. A large proportion of the quicklime from the kilns is dealt with by the hydration plant in which it is mixed with sufficient water to slake it to a dry powder.

A 50-h.p. motor serves a quicklime crusher and the stirrer in the hydrator proper (horizontal drum). The crude slaked lime is fed into an air separation system by which the finer material is removed in strong air currents to bag-filling equipment. The air separation plant proper has a 50-h.p. drive.

The site sub-station is connected to the Bristol-Wells 11-kV ring main, and it houses a Crompton cubicle h.p. switchboard, Hackbridge transformers and Hewittic glass-bulb rectifiers for a d.c. supply for variable-speed drives. As is the case with most of the sub-stations the switchgear erection work was carried out by Messrs. Christy Bros., Ltd., who are the contracting engineers to, and founders of, the company.

The day and night load at the new Rock Colliery, where electricity is consumed throughout, including the coal face, and where there is a total of about 500 h.p. of motor load, is, of course, a help towards the undertaking's good load factor.

Solomon's Temple in Gough's Caves, Cheddar

We were surprised at the number of small wayside pumping stations in the area for railway locomotives. Each has up to, say, 12 h.p. of plant, but, of course, the load is very intermittent. Cider factories are responsible for considerable but seasonal load. A typical factory at Long Ashton is responsible for a consumption of 12,500 kWh per season, and has about 25 h.p. of plant installed to deal with the washing, crushing, elevating, pressing and conveying processes involved.

Not every undertaking can claim two lighthouses as consumers. The one at Burnham-on-Sea, with its 1,000-W lamp (high light) and 500-W lamp (low light), is claimed to be the first lighthouse in this country to be automatically electrically lighted. Electrically, at any rate, the country town printing works at Paulton is as up to date as its big London brothers. Its power, lighting and heating loads combined are responsible for a consumption of about 750,000 kWh per annum, but it is a day-time load and there is a good deal of evening overlapping in the winter.

At the new C.W.S. bacon factory at Shepton Mallet the 90 kW of load is represented mainly by refrigeration. Although a good deal of energy is used for pie cooking, sausage making and the treating of by-products for manure, a more novel electrical use is the stunning before killing of 1,200 pigs per week by 70-V portable shock equipment. A 60-h.p. motor drives the grinders in the small country provender mill at Congresbury, and for agitating and pumping there are motors of about 55 h.p. at Burnham brewery.

Although in crustless cheese manufacture the principal operations in the factory at Wells of the Wilts United Dairies, Ltd., seems to be grinding between granite rolls, stirring in cookers or sterilisers under vacuum and filling and conveying, it appears that the greater part of the 340 h.p. installed is devoted to air conditioning, box making, air compressing and cold storage, box printing and laundry work.

There is very little arable land in North Somerset, and the use of electricity on the many very small dairy farms seems to be confined to 2-h.p. milking machines and 5-h.p. motors for chaff cutting and root pulping. We saw how the streets of Clevedon are lighted by twin bi-multi fittings supplied by the Electric Street Lighting Co., Ltd., each with two 100-W lamps.

It was explained that the dual-lamp idea prevented a total absence of light because the probability of both lamps failing simultaneously was extremely remote, and while one lamp remained alight in a fitting the replacement question was not so urgent. Stratton-on-the-Fosse is a typical example of the many small villages with just a few hundred inhabitants in which modern public lighting is installed. Although public lighting extensions out of a village have resulted in a supply to outlying cottages, street lighting is never profitable enough to be the forerunner of a distribution scheme on its own merit. Because of the necessary poles, however, the two ideas seem essentially to go hand in hand.

There is some excellent illumination in Wookey Hole Caves, near Wells, and Gough's Caves at Cheddar. If there was ever a reason for floodlighting it is at these two caves, where the stalagmites and stalactites are shown up to very great advantage.

Solomon's Temple at Gough's Caves, with its "organ pipes" and "archangel's wings," is served by two projectors at 20 ft. distance and a third one 60 ft. away, while the natural and beautiful colourings of the small stalagmites in the "fairy archway" are brought out by means of a lamp concealed behind each. Three ironclad fuseboards in the caves are fed by l.c. armoured cables and incorporate switches for the floodlights. "Maconite" in galvanised tubing connects the fuse boxes to junction boxes, and from the latter c.t.s. cable is "laid" to the fittings. Messrs. Marryat & Place were responsible for the excellent installation at Gough's Caves.

They are evidently great believers in the two-part tariff in North Somerset, for we were told that a reduction in this tariff progressively every year for the past seven years has resulted in 90 per cent. of the energy consumed in the domestic field being sold on this principle. Half of the domestic consumers have adopted this tariff, which embraces a fixed charge of from 7s. 6d. per quarter and a kWh running charge of ¾d. in the summer and 1d. in the winter.

Most of the 2,000 cookers at present on the mains have been sold by hire-purchase within the last three years, largely as the result of the two-part tariff. The great cost of "servicing" cookers in scattered areas, where simple replacement jobs must fairly frequently result in two 12-mile return journeys, has so far held up the initiation of a hiring scheme for cookers, and the same difficulty makes the new hire-purchase scheme with a five years' term and free maintenance highly creditable. However, there is in force a hiring scheme for 1½-gall. water heaters, and the company's free wiring scheme is said to be a huge success.

The undertaking's load is divided up in the following proportions:—Domestic 34.68 per cent. (flat rate 5.36 per cent. and two-part tariff 29.32 per cent.), power 45.05 per cent., public lighting 1.75 per cent., and bulk supplies to subsidiaries 18.52 per cent.

Movements in Madras

It was recently reported from Madras that the Government Committee appointed to consider whether the present system of electricity supply through private, municipal, and Government agencies has worked successfully and efficiently, or whether more satisfactory results can be achieved by forming an Electricity Board as in Great Britain, or an Electricity Commission such as in South Africa, met recently to discuss preliminaries, the chairman (Sir K. V. Reddi) presiding. The Committee is expected to submit a report not later than May 1st next.

In a recent address Major H. G. Howard, chief engineer for electricity, in the Presidency of Madras, said that the Government Electricity Department had made every endeavour to encourage development, simplify tariffs, and standardise voltages and general conditions of service. He said that a certain amount of progress had been made, but that unless the necessary legislation was passed no marked improvement could be made. To show how much remained to be accomplished, he quoted the following examples of consumption per head of the population, extracted from the Mettur hydro-electric project report: Sweden, 825; Great Britain, 370; France, 350; Italy, 270; Mysore (excluding Kolar), 9; Madras, 1.5 (0.5 in 1929).

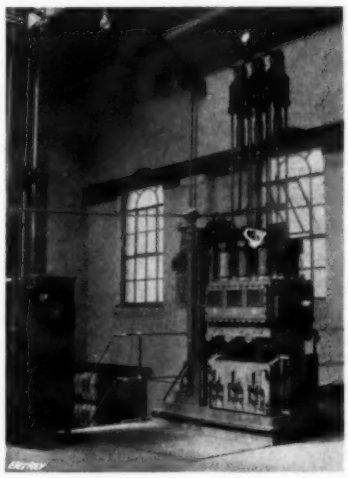
High-voltage D.C. Transmission.

By W. E. French, M.I.E.E.

A field for mercury-jet wave and mercury-arc mutators

WHEN considering high-voltage d.c. transmission by means of a.c./d.c. and d.c./a.c. mutators*, d.c./a.c. mutation regarded as an energy return from d.c. to a.c. systems can be effected either by current or by voltage reversal. The mercury-jet wave mutator is typical of the method by current reversal, where d.c./a.c. mutation occurs naturally and automatically when the voltage of the d.c. is greater than that of the a.c. system; the apparatus reverts as smoothly to a.c./d.c. mutation when the voltage of the a.c. exceeds that of the d.c. side.

The operation of the mercury-jet wave a.c./d.c. mutator has been previously described by me in the ELECTRICAL REVIEW of November 10th, 1933, and July 20th, 1934. Its action for d.c./a.c. mutation is fundamentally the same, and is mainly a matter of the relative alternating and direct voltage values. There is, however, a great difference between the commutation in the two cases. In these articles I pointed out that if commutation is started too near or actually at the zero-passage of the alternating voltage to be mutated the interval required for the completion of commutation might extend too far into the negative half-wave of the voltage, when unstable conditions might arise in that the commutation spark, under the influence of the increasing negative voltages up to amplitude value, develops into a permanent arc which short-circuits the main transformer secondaries at high instantaneous voltages and throws the mutator out of action.



A mercury jet-wave mutator for 200-kW, 500-V d.c. output which has been installed experimentally in a Bradford sub-station

This may happen, although commutation is progressing in the early part of the negative half period. As these negative voltages are in opposition to the leakage reactance e.m.f.'s produced by the commutating currents in the transformer secondaries they tend to neutralise each other. Hence, in a.c./d.c. mutators of this type, commutation must be started a little before zero-passage to secure stable conditions, although this is obtained at the expense of increased spark and commutation losses, since the positive voltages of the first half wave cannot compensate the leakage reactance e.m.f.'s.

With the d.c./a.c. mutator commutation is also arranged to begin in the positive wave slightly before zero-passage, but now, due to the current reversal mentioned above, the current and voltage are in opposition. Consequently, the leakage reactance e.m.f.'s and the positive instantaneous voltages of the first half period are in opposition and so tend to eliminate each other.

A Compensating Effect

Complete compensation can be achieved by starting commutation at an interval from zero-passage at which the instantaneous voltage of the positive half wave equals the leakage reactance e.m.f. The spark and commutation losses become small, and stable working prevails for all conditions, as the commutation interval need not extend into the second half-wave at all. The oscillograms (fig. 1) show this compensating effect. They represent the current and voltage waves flowing in the secondary half-phase of the transformer. That on the left is the oscillogram taken with a.c./d.c. mutation, i and e being in the same direction. The commutator was set to start commutation at an interval equivalent to 2 per cent. of a half-wave before zero-passage. The middle and

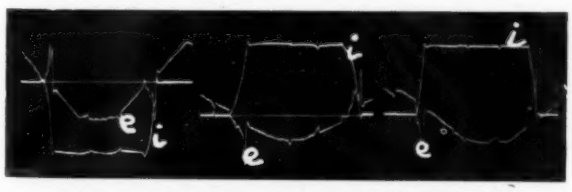


Fig. 1.—Oscillograms showing compensating effect

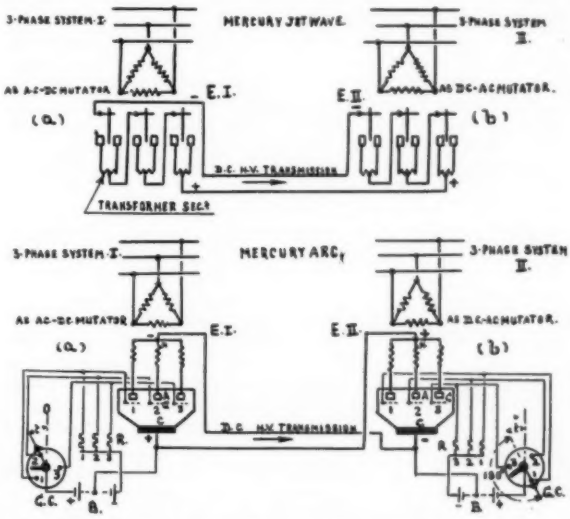
right-hand oscillograms are for d.c./a.c. mutation; here, while the transformer voltages e have maintained the same direction, the currents i appear on the opposite side of the time axis, indicating current reversal. A comparison of the middle and right-hand oscillograms shows that the current falls off much more steeply in the latter. In the middle one commutation starts at 2 per cent. and in that on the right at 12 per cent. before zero-passage, proving that compensation of the reactance e.m.f.'s is much more complete with the 12 per cent. setting.

Figs 2 and 3 show high-voltage transmissions in which two three-phase systems are linked by d.c. ties. Assuming the energy exchange in fig. 2 to be in the direction of the arrow, system E.I. must operate on a.c./d.c. and E.II. on d.c./a.c. mutation. To transmit power as assumed only requires voltage E.I. to be greater than E.II. For power exchange in the reverse direction voltage E.II. must be raised above that of E.I., when the mutators will immediately change their functions.

Three Requirements

The mercury arc is typical of the second method, where d.c./a.c. mutation is by voltage reversal. The action of the grid-controlled mercury arc for this purpose depends on three important points, namely, (1) the grid control can prevent and release the current passage from an anode; (2) it is unable to interrupt or regulate the current of an ignited anode, the current flow, once started, continuing until the potential of the particular anode has fallen to a certain value; and (3) the current flow must always be from the anode to the cathode, whether mutation is a.c./d.c. or d.c./a.c.

Fig. 3 shows that the grids G are permanently connected to the negative pole of the battery B through the resistances R. This provides the grids with a negative potential relative to the cathode. The negative grid potential prevents any current passage from the anodes A. At suitable intervals the synchronously rotating contact arm of the grid control apparatus G.C. successively connects the grids G1, G2 and G3 to the



Figs. 2 (top) and 3.—H.v. transmissions with two three-phase systems linked by d.c. ties

positive pole of the battery, thus subjecting them in a desired sequence to positive potential impulses, which accordingly release the anodes A1, A2, A3 for current passage.

In fig. 4 the working conditions of one anode of a three-phase mercury-arc mutator operating on a.c./d.c. and on d.c./a.c. are shown. At the point Pn the anode A1 ignites and delivers current until its voltage wave intersects that of A2, when the latter assumes duties, and so on. In mutators without grid control this will generally occur at Pn. The diagrams have been drawn on the assumption that commutation, *i.e.*, the current transfer from one anode to the other, is instantaneous, but due to the leakage inductance of the transformer this transfer is not instantaneous, and so the commutation time extends into the working period of the incoming anode. The commutation time is also a function of the load

* A new nomenclature, proposed by Messrs. Brown, Boveri & Co., has been used in this article, according to which valve is designated "mutator," and rectifiers, invertors and frequency changers become "a.c./d.c., d.c./a.c. and a.c./a.c. mutators."

current and may, just as with jet-wave mutators, lead to unstable working if extended too far into the working period of the newly ignited anodes.

With grid-controlled mercury-arc mutators this continuation of the commutation interval into the next half-period can be checked by arranging the $+ve$ grid impulse to occur at *Pf* instead of *Pn*, that is, by a certain interval t ahead of the instant of potential equality of the anodes—in our case of anodes A1 and A3. The control disc must be correspondingly set by an equivalent t in electrical degrees from the position *o* (fig. 3 (a)), which is supposed to coincide with A1-ignition at *Pn*. The corresponding changes to the current wave have been indicated in the figure by the dotted lines. Those of the voltage curves have been omitted; neither are of importance for the present purpose. In this manner A1 (or A2, &c.) can be released earlier by that or any desired interval. Its release can also be retarded over any desired period by the retardation of the $+ve$ grid impulse; it is all a matter of adjustment of the grid-control disc.

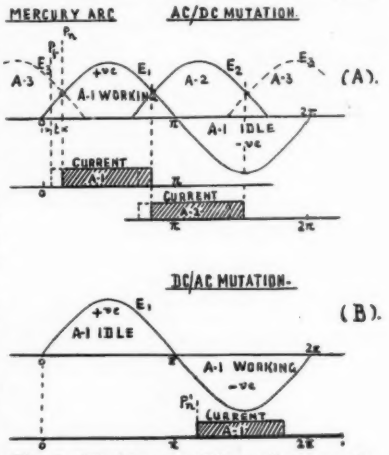


Fig. 4.—Working conditions of one anode of a three-phase mercury-arc mutator operating on a.c./d.c. and on d.c./a.c.

Now, with a.c./d.c. mutation in the mercury arc, current and voltage have the same direction at any moment. Therefore, during the working period of any one anode its potential is positive. When the mercury arc mutates d.c./a.c. the current flows still in the same direction (anode to cathode), but the voltage must reverse. Consequently in this case the anodes must be idle during the $+ve$ half-wave of, say, E_1, and working during the $-ve$ half-wave as indicated in fig. 4B. Neglecting t and referring to anode A1 only, for a.c./d.c. mutation its grid G1 should receive a $+ve$ impulse at *Pn* and remain negative for the rest of the period of E_1, while for d.c./a.c. operation the grid G1 must be $-ve$ and the anode A1 kept locked up to the point *Pn*, fig. 4B, when it is released by a $+ve$ grid impulse. These two points are 180 electrical degrees apart. Therefore, to pass from a.c./d.c. to d.c./a.c. mutation, and *vice versa*, the grid-control disc G.C. (fig. 3) must be shifted by an equivalent of 180 electrical degrees.

According to fig. 3 (b) the anodes of the d.c./a.c. mutator are always held at a $+ve$ direct potential. If the latter is greater than the alternating anode potentials E_1 (or E_2, &c., supplied by system II), then current will flow and energy is imparted to system II, as soon as the respective anodes are released by the action of their grids as described. Hence the potentials E_1, E_2, &c., are now transformer back e.m.f.'s. They must be found, together with the magnetising kVA of the transformer and any other idle kVA of the system to which energy is "returned," by this system itself (as shown in figs. 2 and 3 by system II), because d.c. can transmit kW only. This constitutes a series problem with d.c. high-voltage transmission; it is common to all known methods of d.c./a.c. mutation.

The foregoing shows that mercury-jet wave mutators pass from a.c./d.c. to d.c./a.c. when *one* condition is fulfilled, namely, that E.I.$>$E.II.; but that for the mercury-arc apparatus the following *three* operations must be performed; (1) E.I. $>$E.II.; (2) the setting of the grid-control apparatus must be changed by 180 electrical degrees; and (3) reversal of the mains, because with the mercury arc "energy return" depends on voltage reversal. Thus, when d.c. transmissions are used as ties between a.c. systems for mutual power exchange, on account of the circuit stability they provide, the mercury-jet wave presents the superior and more elastic link.

Smaller Losses

An example of the improvement which may be reasonably expected from d.c. transmission by overhead lines is given by Dr. Gosebruch (E.T.Z., 1932, p. 453). The double-circuit three-phase Golpa-Berlin line (about 94 miles long) carrying 50,000 kW is much overloaded at $\cos a = 0.9$. The problem is whether it would be advantageous to add a new reserve line or to convert the existing transmission to d.c. With 160 A line current the current density is 1.06 A per sq. mm. and transmission losses are 2,880 kW, or 9.1 per cent. The line is insulated for 110 kV, so that on changing over to a d.c. three-wire system with earthed neutral the permissible direct potential between the outers will be $\sqrt{2}\times110\times2=310$ kV.

One of the double lines could then transmit $300\text{ kV}\times160\text{ A}=48{,}000$ kW. As the resistance per line is 29.6 ohms the transmission losses become $\frac{2\times29.6\times160^2}{1{,}000}=1{,}530$ kW, or 3.2 per cent.

The small losses would enable the current density to be safely increased to 2.2 A per sq. mm., which will raise the power per circuit to 100,000 kW and the losses to 6,650 kW, or 6.65 per cent. Hence, the capacity of the double line will be increased by 400 per cent. Converting one circuit only would improve the transmission by 250 per cent. with much reduced transmission losses. Dr. Gosebruch estimates that the installation cost of the mutator plant is just a little less than that of a new line, and states that the financial, apart from the technical, advantages would have been more pronounced for transmissions of greater length.

The advantages which arise with super-voltage d.c. cables is shown in the table below, given by H. Glaser (B.B.C. Nachrichten, Vol. 18, p. 169). Here three single-core three-phase cables are compared with two single-core d.c. cables of the same conductor section and conveying energy at the same voltages. While the power transmitted by d.c. is only 5 per cent. less than that carried by the three-phase system, the diameter inside the lead sheath of the d.c. cable is only half that of the a.c., cable, since the insulation of a.c. cables must not be stressed beyond 6 kV per mm. (r.m.s.) whereas the dielectric of d.c. cables may be stressed up to 15 kV per mm.

System	Transmission voltage kV	Dielectric stress kV per mm (r.m.s.)	Power transmitted kW × 1,000	Diameter, inside lead sheath units
Three-phase; three-single core cables	110	5.5	61	1.0
D.C.; two-single core cables; earthed neutral	110	12.0	58	0.5

An illustration on page 47 shows a mercury-jet wave mutator for 200 kW, 550 V d.c. output which was installed, for experimental purposes, at the Four Lane End sub-station of the Bradford Corporation.

The I.M.E.A. Convention

AS we briefly mentioned in our last issue, the preliminary programme for the Edinburgh Convention of the Incorporated Municipal Electrical Association (June 8th to 12th) has now been published.

On the first day the Electrical Exhibition at the Waverley Market will be opened and in the evening the President (Mr. E. Seddon) will hold a reception at the Assembly Rooms, George Street.

The convention proceedings will be opened by the Lord Provost of Edinburgh on Tuesday morning, June 9th, and Mr. Seddon will deliver his presidential address. Immediately after the address Mr. G. H. Lake (Nottingham) will read his paper on "Electric Water Heating" and a discussion will follow. In the afternoon visits are to be paid to the Portobello power station and the works of Messrs. Bruce Peebles & Co., Ltd. The Lord Provost will hold a reception in the evening and this will be followed by a ball.

The whole of the next day (Wednesday) is to be devoted to a visit to the Rannock and Tummel hydro-electric power stations of the Grampians Electric Supply Co.

A paper on "Heavy Duty Electric Cooking" will be presented by Mr. S. C. Hurry, of the Jackson Electric Stove Co., Ltd., and Mr. W. E. Swale, Manchester Corporation Electricity Department. On Thursday morning (June 11th) a luncheon organised by the Electrical Association for Women will take place after the morning session and in the afternoon Messrs. P. J. Robinson (Liverpool) and J. N. Waite (Hull) will present a paper on "Electrical Street Lighting." The annual banquet and ball is to be held in the evening at George Watson's College.

The annual general meeting will take place on Friday morning (June 12th), when, in addition to the formal business there will be presented a report on a resolution referring to the 44-hour week.

For the afternoon a visit to Queensferry and Lauriston Castle is being arranged.

Electricity and Process Steam.

By R. G. Devey, M.I.E.E.

Deciding whether their dual generation by private plant is justified

THE provision of steam and electricity for industrial purposes presents a different problem to-day from, say, twenty-five years ago, when both were obtained from relatively uneconomical plants and, generally speaking, little was known about boiler efficiencies. As many boiler plants operated without such useful auxiliaries as feed-water heaters, economisers and air pre-heaters, flue-gas temperatures were high and the CO_2 content was low, so it is reasonable to assume that boiler efficiencies of the order of fifty per cent. were common. Consequently, the costs of both steam and electricity were high. The gradual development of technical instruments has materially assisted in the improvement of boiler efficiency, which annually is usually at least 80 per cent., and more with high load factors.

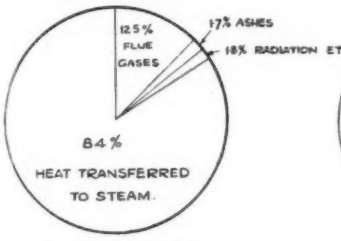


Fig. 1.—Boiler plant

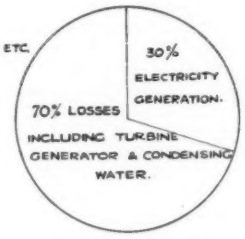


Fig. 2.—Generating plant

With modern condensing turbo-generators combined efficiencies of from 70 to 80 per cent. are obtainable, so that with a plant of large capacity overall thermal efficiencies are obtained up to approximately 25 per cent. An approximate idea of what happens to the heat value of the fuel is given in figs. 1 and 2.

When providing for future power requirements the industrialist has the choice of independent private generation or bulk supply from an authorised supply undertaking. The interconnection of power stations under the 1926 Act has enabled the Central Electricity Board to co-ordinate generation so that the base loads are dealt with by the more efficient stations and the peak loads by the less efficient.

The Grid and Cheap Electricity

This centralised control should make for lower generating cost, although the economy is offset somewhat by the capital and operating charges attached to the expenditure on the grid. It is anticipated that the ever-increasing demand for electricity should eventually bring about a falling price per kWh under the two-part grid tariff charged to the authorised undertaking in the various areas.

The Central Electricity Board has undoubtedly done useful work in preventing the future growth of a large number of small generating stations with their high cost per kW installed and low thermal efficiency. It is equally important that this central body should, while operating to obtain economy in its raw material (coal), give especial attention to capital expenditure the charges upon which can become a very heavy burden and form a large proportion of electricity costs. The industrial load opens a large market to the authorised undertakings, but for industry to be attracted, low prices must be offered. Industry to-day is prepared to purchase its electricity if satisfactory terms and conditions are to be had.

Generally speaking, a works generating its own electricity by condensing units should be able to purchase its electricity from a public undertaking (providing grid supply is available) at a price equal to, or below, its own costs. If not, there appears to be a need for the undertaking to look into its charges.

Many industrial works, however, have a demand for both steam and electricity. In some of these the primary steam at boiler pressure is passed through a turbine or reciprocating engine driving a generator; the steam at a reduced pressure and temperature is finally passed on to process, thereby utilising the remaining available heat up to the point of process temperature. By this means the overall thermal efficiency is increased, as much as 60 per cent. and even higher having been obtained under special conditions. This increase in efficiency is purely a thermal one and does not represent the commercial or £ s. d. efficiency, which, after all, is the most important factor.

A Fallacy

There is no greater fallacy than that expressed in the view, so often heard, that by making double use of the steam electricity is produced as a by-product at practically no cost. The real position is that, under favourable conditions, there is a marked saving in fuel costs which are offset to a greater or less degree by capital charges incurred to obtain this saving.

The increase in efficiency is entirely dependent upon the manufacturing process, and the question of making double use of the steam calls for special and careful consideration in every case. The highest possible thermal efficiency with the lowest capital expenditure is obtainable where the demand for process steam is at all times in excess of that required for generating electricity; in this case a simple back-pressure turbine or engine is used and expenditure on condensing plant and circulating water is avoided. Plants of this type will produce electricity at a cost far below that possible with a condensing turbine of the same size.

Should any of the low-pressure steam from the back-pressure turbine not be utilised in process due to breakdown of plant, or some other cause, and the full electrical load is to be maintained, the surplus would go to atmosphere and create serious heat losses. It should be remembered that the weight of steam per kWh would be several times that required in a condensing unit.

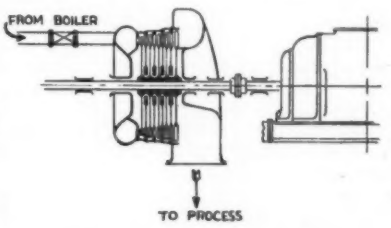


Fig. 3.—Back-pressure turbine

When the steam required in process is at times less than that required to generate electricity, the back-pressure turbine is unsuitable. To deal with these conditions a pass-out turbine is used; this is similar to the back-pressure type, but is fitted with low-pressure stages, finally exhausting the steam not required for process into a condenser. Its capital cost for similar output is more, due to the addition of low-pressure stages, condensing and circulating-water plant and additional foundations, while the overall thermal efficiency is less, due to the heat given up to the circulating water.

The pass-out type is a very flexible unit and probably the most popular, as it allows for considerable variation in both steam and electrical demands. The mixed-pressure turbine is designed to meet cases where steam at boiler pressure is used to generate electricity with units operating under condensing conditions, while in addition there is a further source of steam available at low pressure from process, or even the collected exhaust from steam engines, which is passed into the turbine at the low-pressure end, finally exhausting into the condenser. This type calls for added expenditure, as the condensing and circulating-water plant is larger than that required for the pass-out type. Fuel economy is obtained due to the double use of steam supplied to the turbine at the low-pressure end.

The low-pressure turbine finds its use in works where large quantities of steam are available from process, engines and various types of heating plants, low-pressure steam being

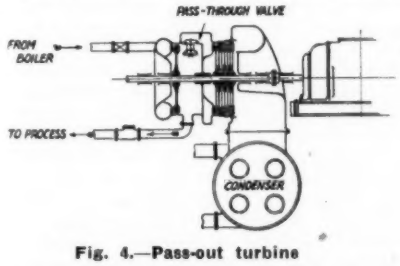


Fig. 4.—Pass-out turbine

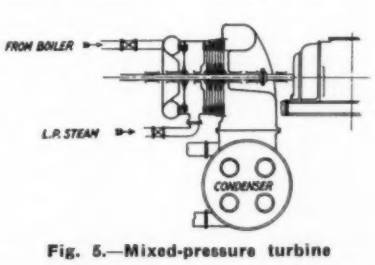


Fig. 5.—Mixed-pressure turbine

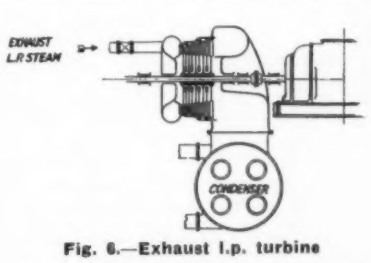


Fig. 6.—Exhaust l.p. turbine

passed into the turbine and thence to a condenser, which, with its circulating-water pumps, should be capable of dealing with the full steam input. Fuel economy is obtained by extracting, in the turbine, part of the remaining energy from the steam before it is finally exhausted to the condenser.

As steam can rarely be purchased from an outside source a steam raising plant has to be installed in any case. The following methods of providing electricity are available from which to choose (after allowing for all charges) the one offering

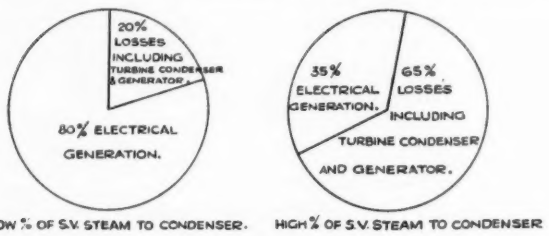

20% LOSSES INCLUDING TURBINE CONDENSER & GENERATOR.
80% ELECTRICAL GENERATION.
35% ELECTRICAL GENERATION.
65% LOSSES INCLUDING TURBINE CONDENSER AND GENERATOR.
LOW % OF S.V. STEAM TO CONDENSER.
HIGH % OF S.V. STEAM TO CONDENSER

Fig. 7.—Electrical generation by pass-out turbine plant

the lowest cost per kWh. (1) Purchased power from outside source, thus avoiding capital expenditure on generating plant. (2) Straight generation by means of 100 per cent. condensing-type generating units. (3) Back-pressure, pass-out, or other types of generating units, any of which utilise heat and pressure drop by which useful work is done in generating electricity and in passing on, as far as possible, the surplus heat to process work.

Advantages of Public Supply

It should be borne in mind that the public supply is unlimited and quickly meets the industrial demand when manufacturing outputs are increased, compared with the necessity for extensions to private plant. This has recently been made possible on a very large scale, as the interconnected grid enables power to be transferred from one area to another. Public supply is on tap at all times, whereas private plants are expensive to operate during week-ends, nights and holidays, when the electrical demand is low, and require space for plant sites and fuel storage. The heating of buildings offers no commercial advantage in the double use of steam, as it is only required during the winter. The figure of £ per kW installed is, generally speaking, higher for private than for public generating plant, mainly on account of the relative sizes, but in small plants of the " self-contained " type the cost is sometimes lower than for plant of the super-station type.

The next consideration is the nature of the goods to be manufactured. Many works have large power and small steam demands; for example, in general engineering works practically no heating steam is required, therefore there is no case for combining the generation of steam and electricity. In such instances an outside source of electricity should generally prove to be the most economical, heating steam being obtained from an inexpensive low-pressure steam-raising plant. Another type of works is that in which the requirements for steam are large and for power small. In this the full back-pressure turbo-generator is suitable, and the capital cost of condensing plant is eliminated. A further type is that in which there is a large demand for both steam and electricity

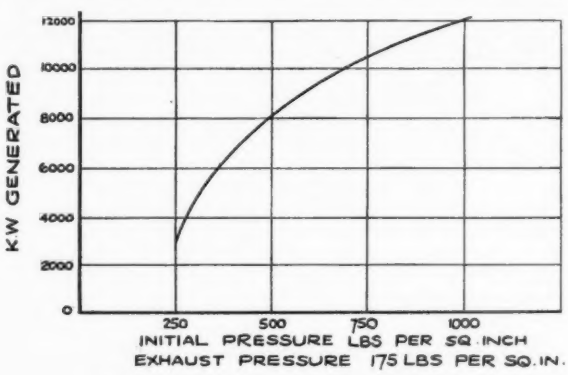


Fig. 8.—Steam pressure and kWh generated

in variable quantities. Usually the pass-out type of turbine is installed in which part condensing is necessary, entailing additional capital expenditure on that account.

With the pass-out type of plant, the overall turbine thermal efficiencies possible for normal boiler pressures vary with the percentage of the total stop-valve steam condensed as shown on fig. 7. It may be as high as 80 per cent. with small quantities condensed, about 60 per cent. for the conditions obtaining in the paper-making and similar industries, and as low as 35 per cent. when large quantities are condensed. Assuming a boiler efficiency of 80 per cent., this gives approximate overall efficiencies of 64, 48 and 28 per cent. respectively, as compared with a super-station's figure of 25 to 28 per cent.

A Case for Private Generation

When the steam and electrical power demands are almost identical, following a straight line, and any variation in steam demand is followed closely by a similar variation in electrical demand, such as in paper-making, a direct case is provided for private generation as the capital expenditure on condensing and cooling water is a small proportion of the cost of a full condensing plant.

Other important factors are involved in the double use of steam to generate electricity and as a heating medium for process. For instance, the plant load factor, as with a 100 per cent. condensing type, probably affects the annual efficiency of the plant more than any other single item. Also, it should be emphasised that the prospects of financial advantage vary with the capacity of the plant, there being generally more potential gain with the smaller sizes.

The efficiency of steam-raising plant does not vary much between medium and high-pressure, therefore, if steam only is required pressures exceeding 250 lb. per sq. in. are seldom necessary and often lower pressures meet process requirements. Steam temperatures are governed by the heat required for process work. When a boiler pressure of, say, 200 lb. per sq. in. is in use, lower pressures and temperatures can be obtained by means of automatic regulation; the steam is de-superheated to the required temperature, the heat loss in reducing both the pressure and temperature being of a negligible amount.

With such double use of steam, pressures are increased above that normally required for process, which increases the capital cost of the steam-raising plant, thereby increasing the cost of steam due to the additional capital charges, which become a debit against the electrical generating cost. Fig. 8 shows approximately the increase of generating capacity with increase in initial pressure, the steam temperature in each case being 800 deg. F. and the quantity 300,000 lb. per hour. The cost ratio of boiler plant against pressure is approximately as shown in fig. 9.

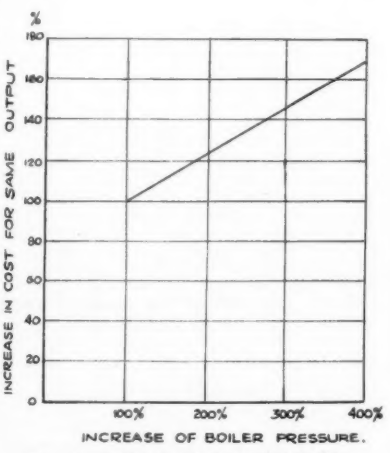


Fig. 9.—Increase of cost with boiler pressure

The Lancashire boiler is popular in works where low pressures are required, but it is usually limited to 250 lb. per sq. in. If higher pressures are required the water-tube boiler finds a large use. For low-pressure work the capital cost of a Lancashire boiler is approximately 70 per cent. of that of the water-tube.

An exceedingly important point is that of boiler feed-water; when electricity is generated by a turbine set, the exhaust of which is passed into a surface condenser, 95 per cent. at least can be returned to the boiler without treatment; only 5 per cent. make-up or less calls for treatment.

When steam is put to the double use of generating electricity and providing process heating, unless it is passed through heating coils or some form of heat exchanger, the condensate cannot be recovered, and the feed-water make-up may, therefore, reach a figure as high as 100 per cent. With high boiler pressures feed-water treatment plant is required, and with extra-high pressures evaporating and de-gassing plant. This calls for heavy expenditure, the capital charges on which must be debited against the production of electricity and not of steam when comparing electricity generating costs with the 100 per cent. condensing unit or public supply.

Careful Investigation Necessary

Manufacturing problems are so varied that each one calls for independent consideration. Works with one simple line of manufacture present an easier problem than when there are

a multiplicity of lines, the latter demanding very careful investigation to obtain a reasonable balance of steam and electricity.

Trade fluctuations, the constantly changing lines of manufactured goods, and in large companies with many works the transfer of lines from one to the other, all come into the picture and often upset former designs of plant to meet heat and electrical requirements.

Possible Future Developments

The industrialist taking a long view puts down plant for a twenty-year life as regards depreciation account. What will be the cost per kWh of the public supply of the future as a result of the ever-increasing demand due to the greater use of electricity?

A pre-view of future developments might reveal the further development of the already established super-pressure boiler for about 1,500 to 2,000 lb. per sq. in., which would open up a greater possibility for the double use of steam with temperatures exceeding 900 deg. F.

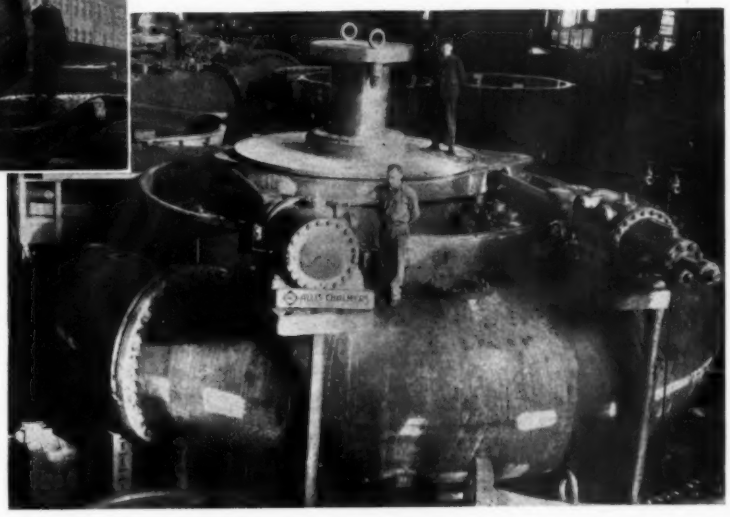
Improved design or, perhaps, the use of the steam transformer, will tend to remove the cause of troubles brought about by impure feed water, that now cause anxiety in the operation of boilers and turbines. Will the authorised electricity undertakers give their attention to heat distribution by high-pressure water as well as by electricity? This would provide a means of raising the low overall thermal efficiency and thereby providing electricity at a lower cost to industry. The planning of industry in the vicinity of super power stations also presents possibilities.

Turbines at the Boulder Dam. By F. Johnstone Taylor

Units which develop 115,000 h.p. on a 475-ft. head

THE main purpose of the Boulder Dam is to use the waters of a comparatively narrow canyon on the Colorado River for generating electricity. Of the arch gravity type of construction, its length is not considerable, but its height of 726 ft. calls for a base width of no less than 660 ft., involving some 2½ million cu. yd. of concrete and an estimated finished weight of 6½ million tons.

The initial installation comprises four 115,000-h.p. vertical-shaft Francis turbines, built by Messrs. Allis Chalmers, which operate under a net head of 475 ft., though the output is limited to the 82,500-kVA capacity of the generator to prevent overload at the maximum head, which may rise to 592 ft. This is accomplished by a positive locking device on the governor servo-motor, which prevents excessive vane opening. The runners have a speed of 180 r.p.m. to generate 60 cycles, the standard for the area of supply.



A section of the turbine spiral casing ready for transit, and (right) one of the four 115,000-h.p. turbines in the erection shops of Messrs. Allis Chalmers

This class of turbine is the one most extensively used in America, and the sets are not so much remarkable for any radical departure from the orthodox as for the massive proportions of the various parts and the extensive use of cast-steel in place of cast-iron. The spiral casing, 10 ft. in diameter and weighing 500,000 lb., has been subjected during shop erection to a test pressure of 500 lb. per sq. in. Individual sections weigh over 84,000 lb., the heaviest being that with a branch for the governor-operated pressure-relief valve. The latter is often found on turbines of this class, its purpose being to pass to waste some of the water rejected on diminution of load while the turbine and the flow in the penstock are settling down to the reduced load.

Method of Control

Control is by the usual system of pivoted guide vanes, which have 8-in. diameter stems cast integral and guided in three bearings. Of these, one is below the body in the discharge ring, one above the body in the cover plate, and one above the stem packing box immediately below the guide-vane lever. The last two are connected to the central shifting ring by links and pins, one pin being of small section, so that an obstruction resulting in the jamming of a guide would cause it to shear. The shift ring is operated by two servo-motors, which are worked by the usual oil-pressure system, but at the rather high pressure of 300 lb. per sq. in. The main shaft, 38 in. in diameter, is of compression-forged steel, and is supported in an automatically lubricated guide bearing with babbit liners.

The discharge passes through the usual form of elbow-draft tube, but, in accordance with the now generally accepted practice for vertical-shaft turbines operating under appreciable head, the vertical portion is lined with steel to resist erosion here and also to provide a rigid form for the concrete of the supporting monolith. In the present instance this is partly in the form of a welded-steel liner, but the upper connection to the turbine casing is in the form of a taper tube forming the discharge ring and the upper portion of the draft tube. They are formed of several cast-steel sections, which are provided with machined flanges for bolting together.

Some important features attach to the pressure regulator, principally in connection with its capacity for dealing with 80 per cent. of the full discharge of the turbine; this has called for parts of exceptional strength and for the installation of an energy absorber between the orifice of the pressure regulator and the elbow discharge.

This causes the water stream lines to be directed against each other and so to translate part of the kinetic energy into heat which is readily absorbed by the water. This part of the control system, which takes the form of a needle valve, can function either as a by-pass for water-wasting control or as a water-saving device.

For handling the heavy masses in a relatively confined space an auxiliary crane has been provided which can be used in any of the turbine pits, transfer being accomplished by the main crane through hatch openings. It runs on a track situated below the power-house floor and below the generators.

A portion of the main shaft is a spool that can be removed by the auxiliary crane, after which the latter can move over the turbine and be used to lift the runner or any other part of it.

The Glare Problem. By D. G. Sandeman, B.Sc., A.M.I.E.E.*

Examining street lighting from a new point of view

AT the present time there is a divergence of opinion regarding the type of lantern best suited to street lighting. On the Continent a simple lantern is adopted which throws the bulk of the light downwards, the cut-off being at angles approaching the horizontal. In this country the general practice is to adopt a unit which throws more light into the eyes of the approaching driver and to adopt longer spacings. Both systems can produce excellent results, and the ideas are not necessarily at variance. Recognising that glare is of the utmost importance, is it possible to design a street lamp which will give a constant amount of glare? If this can be accomplished the resulting visibility should be a stable quantity, unaffected by the speed of the observer's vehicle, and in contrast to the variable visibility due to glare that is usually experienced.

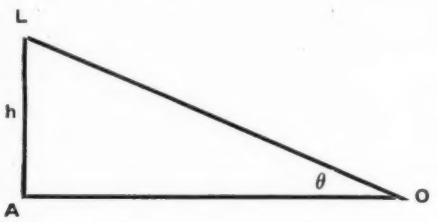


Fig. 1

The eye requires a definite time to adjust itself to new conditions of glare, and this factor, together with the strain introduced, is a potential source of accidents.

If a lamp is situated at the point L and the observer's eye at O in fig. 1, then OA is horizontal. The glare effect is proportional to the illumination at O divided by $\theta^{3/2}$. If the vertical distance LA=h is kept constant the glare effect can be shown to be equal to $1/h\theta^{3/2}\text{cosec}^2\theta$ where I is the candle-power in the direction LO. It will be evident that the vertical height h is of primary importance, the glare effect varying inversely as its square. For example, this figure h, with the recommended mounting height of 25 ft., is approximately 20, and compares with a corresponding h of 6 in the case of suburban gas lamps. The square of the ratio is approximately 11, meaning that the low-mounted lamp is eleven times as glaring for equal candle-power as the 25-ft. mounted lamp.

The complete curve of $\theta^{3/2}\text{cosec}^2\theta$ is plotted in fig. 2. If I is made equal to this function at every angle, then the glare effect will be equal to $1/h^2$ at every position, and visibility will be stabilised.

It will be noted next that the prevalent practice of providing a maximum beam at 75 deg. will give very glaring results. If the beam is raised to the horizontal the best conditions are obtained.

This experiment has been tried with success; in fact, the adjustment of the beam to the horizontal was so successful that the curve in fig. 2 was produced in an attempt to supply a theory to explain the improvement. By raising the beam of light the efficiency of an ordinary lamp is reduced, because a large part of the flux is being delivered above the horizontal. Continental lamps are designed to take advantage of the lower part of the curve, and our own fittings make use of the higher angles which are important.

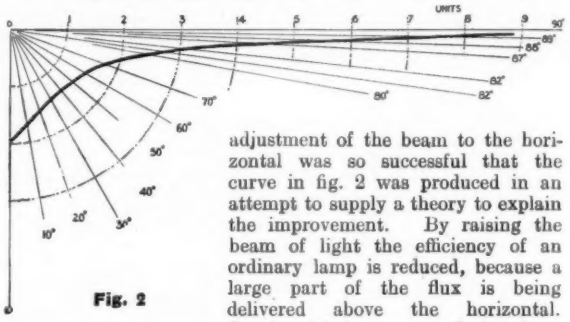
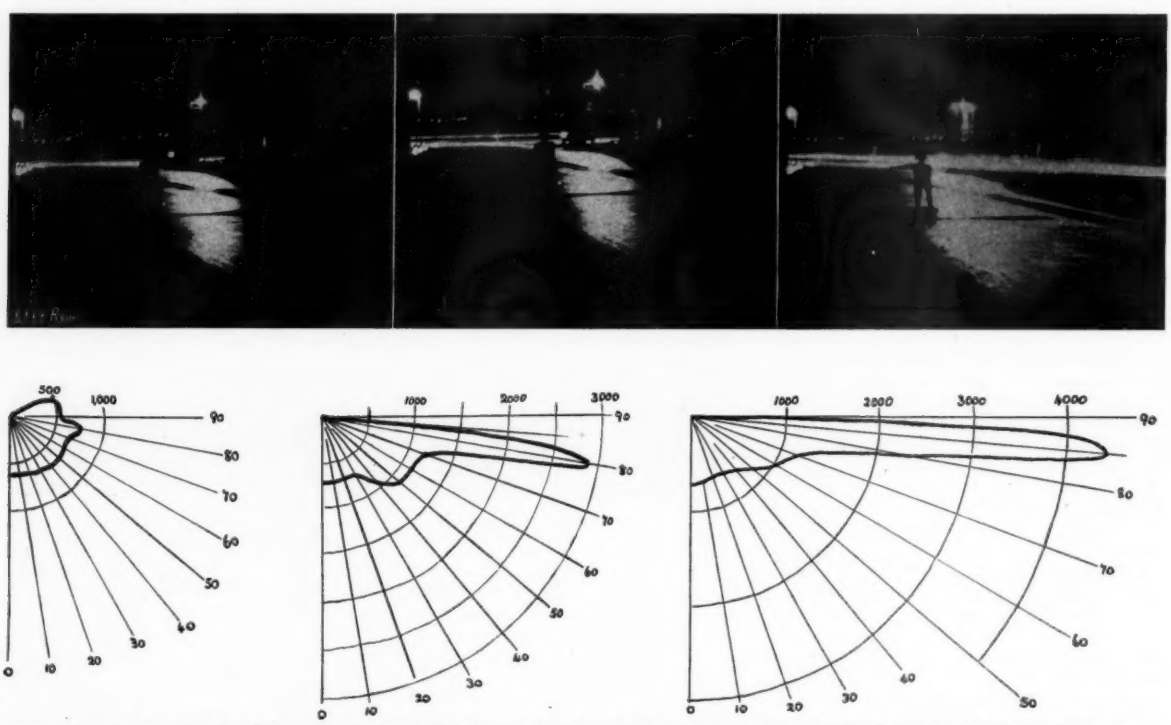


Fig. 2

It is quite usual in street-lighting work to make use of a lamp situated 300 or 400 yards distant to illuminate a roadway. In this connection it is of interest to compare the average surface brightness of the road when viewed at close quarters and at long range. It is found that for the usual polished surface the resultant surface brightness is the same at 300 yd. as at 100 yd. with suitable lanterns. Street lamps have an almost unlimited range of usefulness on straight stretches of roadway. Nature has perfectly compensated for the fall in illumination as we recede from a lamp by altering the reflecting properties of the road surface. The accompanying photographs, which were taken in Edinburgh by the laboratory staff of Mr. N. G. Wilson, city inspector of lighting and cleansing, illustrate the importance of throwing the light in a horizontal direction. The polar curve of the lantern is given under each. It will be noticed that very little advantage is gained by adopting a refractor throwing the beam at 80 deg., the bare lamp giving almost identical results. The fitting giving its maximum candle-power at 85 deg. is seen to give the best results.

It may be possible to procure a lantern designed to approximate more closely to the curve of $\theta^{3/2}\text{cosec}^2\theta$.



Photographs of experimental lighting with a 500-W lamp, toget her with polar curves. The first installation has a bare lamp and the second a refractor throwing the beam at 80 deg. from the vertical. The last fitting gives its maximum c.p. at 85 deg.

* Assistant Inspector of Lighting, Edinburgh.

Meetings and Discussions

Control by Thyratrons
Meter Testing
Aerial Radiation Resistance

The Use of Thyratrons in Industry

THE paper in which MR. A. L. WHITELEY, of the B.T.H. Co., Ltd., describes some of the many ways in which the hot-cathode grid-controlled thermionic type of rectifier may be employed as a control actuating device (to which reference was made last week) was discussed at the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 2nd. The first speaker, Mr. R. LE ROSSIGNOL, considered it good policy not to recommend the use of minimum operating power. Some reserve was desirable and it was not advisable to allow the current rise to be too sharp, in order to avoid injuring the cathode. He believed more argon-filled thyratrons would be used when constancy was needed, notwithstanding the necessity for cleaning the argon gas; also they did not require so high a voltage as the mercury-vapour type.

For some classes of control the thyratron was in a class by itself; for instance, it was a " perfect joy " to watch a seam welder controlled by this device in a way that was quite impossible by any other means. Many control operations could be done equally well by a pool type of rectifier, thereby avoiding the risk of cathode destruction by current surges, even if a larger operating current and auxiliary heating were needed.

Mr. L. B. TURNER suggested that the existence of harmonics in the mains supply might affect the proper functioning of thyratrons. The non-ohmic resistance bridge employed for voltage regulation was an important device, and would be used for other purposes. In place of " Thyrite " he had used small vacuum lamps with fine filaments (under-run at low voltage) and so avoided ambient temperature troubles.

Mr. F. E. OCKENDEN, who used the term " gasfilled triode " instead of thyratron, explained how he had employed a single valve circuit for protecting high voltage overhead lines. Each of the three-phase lines was earthed, *via* a condenser, through a single-point tuned circuit that shorted-out all harmonics. Thus only 50-cycle current could actuate the protective gear. When one phase became earthed a small current would flow to earth and so provide sufficient p.d. to cause a single valve to trip the circuit-breakers. He exhibited a valve which had been so employed for a whole year and still appeared to be as good as ever.

Mr. C. R. DUNHAM referred to the amazing variety of uses to which thyratrons could be put and emphasised their instantaneous operation. It was advisable to employ a grid voltage of steep wave front in order to get over the temperature gradient of mercury valves. One advantage of these devices was that they were totally enclosed and so could be employed in dangerous atmospheres without risk of igniting gases. A valve might last 9,000 or 3,000 hours; some means of detecting incipient failure was needed. Prof. C. L. FORTESCUE inquired whether the change of the arc from the safe to the dangerous state (relative to cathode destruction) was sudden or gradual. The author should refrain from using the term " d.c. voltage." Mr. BASIL WOOD thought that there was some danger of pushing the use of thyratron valves too far. Were they really suitable for industrial application, apart from welding control wherein nothing else could equal them? Other types of voltage regulator were so well established that operating engineers were likely to think long before attempting to apply thyratrons to the control of generator voltage.

Mr. G. F. SHOTTER stated that he was now using thyratrons for transmitting metering impulses, thus removing all contacts, without affecting the meter's accuracy or performance. The valves so used were helped as much as possible by avoiding voltage and current maxima. He hoped they would not need to be renewed too often. Another speaker remarked that replacement could be facilitated by mounting the valves on a turntable.

The author stated in his reply that this expedient was not necessary. Duplicate valves could be employed with their electrodes connected in parallel. No pair was exactly alike, so that one would remain idle pending the failure of the other.

The author also pointed out that every gasfilled triode was not necessarily a thyratron. He was not prejudiced in favour either of gas or mercury filling, so long as the valve was a thyratron. All kinds of inert gas (which needed very careful cleaning) had been tried and argon seemed to be the best, although the life of an argon-filled valve was only one-third that of the mercury-vapour type.

When the function was precise measurement an argon valve might be needed, but for control purposes a mercury type was preferable. Many of the remarks in the paper would apply equally well to pool type rectifiers. The manufacturers felt safe in guaranteeing a life of 2,500 hours, which represented a year's use for eight hours per day. An arc-drop measuring device had been employed across the tube to detect incipient failure. Thyratrons could be installed near radio apparatus without risk of causing interference such as would be caused by vibrating devices and circuit-breaking gear.

* * *

Modern Meter Testing Methods

THE inaugural address of Mr. O. HOWARTH as chairman of the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 3rd, consisted in the main of a description of the more important features of the Testing Department of the Lancashire Electric Power Co. The greater part of the company's business consists of power and bulk supplies. Its three generating stations are all " selected " and the maximum load on the distribution system is about 100,000 kW. Over a considerable portion of its area of 1,000 sq. miles the company operates Provisional Orders and affords three-phase, four-wire, 400/230-V supplies from l.v. networks. The total number of consumers supplied from these networks is about 40,000.

Mr. Howarth stated that while the domestic business had increased considerably during the last decade, it was still a very small proportion of the total. This fact had influenced the design of the Testing Department, owing to the smaller proportion of single-phase meters to be dealt with than was the case in most undertakings of similar size. A new single storey test building was occupied at the end of 1929. When the responsibility for the installation and maintenance of such domestic appliances as were hired from and sold by the company was added to the duties of the Test Department, an extension building was occupied in the summer of 1934 to deal with that work.

The laboratory is 58 by 33 ft., and along the north side is a trench 7 ft. 6 in. wide and 4 ft. deep with the instrument benches carried over it on reinforced concrete pillars. The transformers, phase shifters, and heavy connections are housed in a well below floor level. Four testing sets with substandards and master standards are accommodated on instrument benches, while three double-sided meter-testing racks are arranged north to south across the room. All h.v. gear is housed and used in one angle of the laboratory, which also contains a separate rack for time switches and other apparatus requiring long time tests. There are a dark room and workshop, the proportion of workshop space to testing laboratory space being less in a department dealing almost exclusively with a.c. meters than in one dealing with a considerable proportion of d.c. meters. On the south side are a garage and stockroom with steel racks on which meters are hung and a bank of steel shelves across the room. An attic over the offices is used for storing records.

The building is warmed electrically by thermostatically controlled tubular heaters. The capacities are 58,000 cu. ft. and 42 kW. The highest heating demand is 35 kW and the consumption 110,000 kWh per annum. The resulting cleanliness, comfort, and convenience are most gratifying. As the building is exposed the heating conditions are fairly severe.

The incoming supply is obtained from a step-down substation across the road, which is very close to the principal generating station, resulting in a very steady voltage at the laboratory busbars. Mr. Howarth described the four testing sets and associated equipment, explaining with the aid of diagrams how currents and voltages are obtained, with fine control by one liquid resistance wheel up to 1,000 A. Link and plug boards enable any of the testing sets to be connected to either side of the test racks through cable trenches, the floor being covered with rubber. Once a meter is set up it is not necessary to alter any connections, all changes being carried out by links and plugs.

All the transformers, including current transformers, have been designed and constructed, and the whole of the apparatus has been designed and installed, by the Department's own staff. Current transformers with " Stalloy " cores are now being replaced by others having " Mumetal " cores, and

voltage transformers up to and including 33,000 V can be tested. In addition to meters, protective gear is tested on site before being put into service. For this purpose portable transformers have been constructed for obtaining up to 1,000 A at 10 V. For testing the stability of protective gear a transformer has been made to give 10,000 A at 5 V, or 5,000 A at 10 V.

An instrument has been produced for testing the speed of operation of switches and relays, and other equipment includes a glass tube cathode-ray oscillograph and a set of klydonographs constructed for investigating surges on the 33,000-V system. These are designed to use standard 8.5 by 6.75 in. photographic plates, all three phases being recorded on one plate, which provides a record for thirty hours. Daily changes during the year had given records of more than 250 surges.

Under a staff recruitment scheme youths are given employment on leaving a secondary school. Wages are fixed by a scale which provides for annual increases up to the age of twenty-three years, but dependent upon satisfactory progress being made at work and at evening classes. The first year is spent in the office, the student becoming acquainted with staff and routine. A period in the testing laboratory follows, cleaning and assisting to prepare meters for test. At the age of eighteen, students are put on rota, one month outside fixing meters and connecting up consumers and one month inside in reserve for outside work. During some of their inside periods they have spells in the workshop and in the domestic appliance section. By the time they are twenty-three years old it is possible to decide the kind of work for which each is most suited. There are now three leading men at this stage, in their early twenties, respectively in charge of three- and single-phase meter testing, of installation and of rectification of defects on site. To avoid monotony they are changed round each month and the scheme is very satisfactory.

The address concluded with a reference to the certification of meters. Mr. Howarth asked if the case of Josephs *v.* East Ham Corporation (in which a consumer's meter was held to be illegal because it had not been certified by an "electric inspector") would ultimately result in some drastic change in the present meter routine of supply undertakings. In Mr. Howarth's judgment it is inevitable that some action will be taken. To be satisfactory to all parties such action must not add appreciably to the cost incurred at present by supply undertakings in providing the meters, and it must ensure the standard of accuracy now achieved by those undertakings with competent testing departments.

In the chairman's view there is a simple way out of the difficulty. The Act calls for the certification of each meter by an inspector, but it does not lay down the manner in which he must satisfy himself as to the accuracy of the meter. Mr. Howarth suggests that the inspector should satisfy himself as to the adequacy and accuracy of the testing and the records kept by competent testing departments, and should consider all meters to be certified provided the records were produced to him upon demand. He should, of course, make calls for inspection, without notice, at his discretion. Those undertakings without a competent testing department would have the option of establishing one, or they could have their meters tested by a competent authority.

In Mr. Howarth's opinion such a course of action would not unduly burden the supply undertaking, and would give the consumer the protection to which he is undoubtedly entitled; protection, in fact, equal to that given to the retail customer under the Weights and Measures Act.

* * *

Radio Transmitting Aerials

THE radiation resistance of aerials whose length is comparable with the wavelength is discussed in a mathematical paper by Mr. E. B. MOULLIN, of the Engineering Laboratory, Oxford University, which was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 8th. The author calculates the electric force at any point of a vertical aerial, and also the power radiated from it, showing that the power can always be expressed as a factor multiplying the square of the field strength at an assigned radius in the equatorial plane.

This is called the height factor, the problem being to find the height of aerial that will minimise it, for then a given direct-ray communication can be produced with the minimum power and external annoyance. The expression for the height factor is very general and is applicable to any distribution of current: it is expressed as an infinite series of certain simple functions of the current distribution, being the first, second, third, &c., moments of area of the current-distribution curve.

The calculated values of radiation resistance for a sinusoidal distribution of current agree, to within a few parts in a thousand, with those calculated in 1923 by Ballantine, who used the process of viewing the aerial from a far-distant point.

The height factor is insensitive to the form of the current-distribution curve, provided this has a constant area. Hence the output of any aerial can be predicted with certainty, provided that the value of the "metre-amperes" is known; this can be deduced if the field strength is measured accurately at a comparatively close point located in the equatorial plane.

For a given length of aerial minimum power obtains when the aerial is vertical; it follows that if a single mast of given height is available then the most economical aerial which can be employed is a straight vertical wire. A general expression derived for the height factor of an aerial with a flat horizontal roof (of either the inverted "L" or the symmetrical "T" types) shows that if the current distribution along the up-lead and roof is part of the same sinusoid, then the height factor of a roofed aerial is greater than that of a vertical aerial of the same total length; and that with masts of given height it can be an advantage to omit the roof. The analysis of the roofed aerial shows that it would be economical of power to obliterate the radiation from the roof by folding up the roof. This might be done by coiling the roof into a flat spiral centred on the top of the up-lead, an arrangement which would be reminiscent of the Franklin phasing coils used in beam arrays. A given length of wire disposed in an up-lead and folded roof is never as economical of power as the same total length of wire disposed vertically, but in general a mast of given height can be used more economically if fitted with a suitable folded roof.

Reception is discussed briefly to show that the current distributions in reception and transmission are not the same. Finally, equations are developed for solving the current-distribution problem, and a second approximation is made to the distribution in a vertical half-wave aerial.

New Books

Nel Cinquantenario della Società Edison; 1884-1934. 4 Vol., illus.. Pp. 510+487+632+318. Milan: Società Edison.

The Società Edison of Milan (which is claimed to be the oldest and one of the largest electric public utilities on the Continent) has published this work in celebration of its golden jubilee. It is a comprehensive attempt to trace the history of the technical and economic developments of the electric power industry in the world from its beginnings. Each subject is treated by a qualified author under the general editorship of Prof. Giorgio Mortara, of Milan University, who has also made some of the more important contributions.

The first volume is purely technical in character and illustrates the evolution undergone by the vital parts of generating plants (both hydro and steam) and transmission systems. The earlier part of the second volume is devoted to the general economic problems of the electric power industry and shows the economic characteristics of the electrical industry to be bound up with the physical properties of electrical energy. From this result both the concentration of enterprises and the differentiation of prices (for different classes of consumers), which are the most evident features of the industry everywhere. The greater part of the second and the whole of the third volume are devoted to the development of the electrical industry in Italy, the United States, Germany, Great Britain, France, Canada, Switzerland, Sweden, Norway, Russia and Japan, tracing differences in evolution in relation to both the economic characteristics of consumption and the power resources in each country.

The fourth of the volumes contains two monographs. The first illustrates statistically the economic development of the city of Milan, with which the Società Edison has always been closely associated. The second monograph deals with the history of the company, from the first modest steam power plant put into operation in 1883, to the present "Edison group," operating 149 hydro-electric and 20 steam power stations, all feeding into a 130-kV grid, with 1,800 circuit miles of transmission lines, which supplies an area of Northern Italy larger than Switzerland.

* * *

Shorter Notices

"Small Alternating Current Motors," by A. H. Avery. Pp. 51; figs. 26. London: Percival Marshall & Co., Ltd. Price 1s. 6d.

"Einführung in die Angewandte Akustik," by Dr. H. J. von Braunmühl and W. Weber. Pp. 216; figs. 154. Leipzig: S. Hirzel. Price Rm. 9.20.

"Boiler Feed Water Treatment." By F. J. Matthews. Pp. 256; figs. and illus. London: Hutchinson's Scientific and Technical Publications. Price 12s. 6d.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Do We Compete with Gas?

The issue of the ELECTRICAL REVIEW dated December 27th contained an article by "Salesman" bearing the above title. I cannot believe, however, the author is an electrical salesman, for an efficient salesman should insist upon dealing only in wares he has confidence in, whereas from the article one would not judge that electricity for lighting had any merit over gas. I would remind "Salesman" that the control of gas points from wall switches dates back many years, and that even those engaged in the distribution of gas themselves prefer electric lighting, and are often sufficiently broad-minded to adopt it.

With regard to "the pet answer" when confronted with the obsolete objection that electricity is dear, *i.e.*, "use enough and under our all-in or two-part tariff we will supply you with a cheap unit," I suggest that he had far better give a simple and correct explanation of the underlying principles of the two-part tariff, which is based on load factor, and not on quantity alone.

As a contractor I cannot agree "that if every contractor and salesman told the truth, we dare not sell enough electric light owing to running cost." The proof of the pudding is in the eating, and I have yet to hear of electric lighting once installed in a house being replaced by gas. The efficiency of the modern electric lamp in conjunction with the ruling prices for electricity, is such that even "decoration by means of electric lighting" is being generously adopted as a good commercial proposition.

If by "standard" lighting installations "Salesman" refers to those put in on a "rental" or "free wiring" system, it must be obvious that all the convenience equipment, such as two-way switching, etc., cannot be installed owing to first cost, but otherwise electricity at prevailing prices competes very satisfactorily and successfully with gas, particularly when such considerations as maintenance, health, decorations, etc., ignored by "Salesman," are taken into account.

December 31st. PRO-ELECTRICITY.

A Question of Policy

In times of unrest it must be a source of very great satisfaction to enemies of our country and Empire to know that the Home Government is permitting the wholesale closing of generating stations and the transfer of the country's industrial load to a few large buildings which, as their capacity is increased, tend to become more distinctive in outline and which, being usually situated alongside waterways and/or railways, form almost ideal night targets for aircraft.

It must be remembered that if hostilities break out against us there will not be weeks or days allowed to us for the reconditioning of derelict generating stations and the recruiting of the necessary staffs. The vital blows will be struck hours or even minutes only after the declaration of war, and I tremble as I try to visualise how we shall get our power for munitions work in such an emergency. Our power supply will be equally vulnerable in the event of a civil commotion as a small body of men operating in the vicinity of a base load power station could cause untold dislocation of industry.

In the interests of the nation's safety I feel that we should all, at home and overseas, give earnest consideration to the following questions: Is our present policy of "putting all our home country's eggs in one basket" really a wise one? Should any scheme for rearmament include the modernising and staffing of all small public service generating stations and also of those of all large engineering works?

H. G. BATSON, Capt. T.A.
Birmingham, *December 29th.* Associate I.E.E.

"D.C. Voltage"

A point was raised during the discussion on Mr. A. L. Whiteley's I.E.E. paper on the thyratron which it would be well to have cleared up once and for all.

A speaker objected to the author's use of the term "d.c. voltage." No alternative term was suggested, and I can find no ruling on the point in the British Standard Glossary. In speaking of a d.c. voltage one implies a voltage which, when applied to an electrical circuit, will cause a direct current to flow in that circuit; in other words, a "direct current producing voltage."

The condensed term "d.c. motor" is universally accepted to imply a "direct-current operated motor," and since no ambiguity or other possibility of misunderstanding arises, I fail to see the objection to condensing "direct current producing voltage" to "d.c. voltage." Otherwise what are we to call a d.c. voltmeter? A. W. CHOWN HIRST.

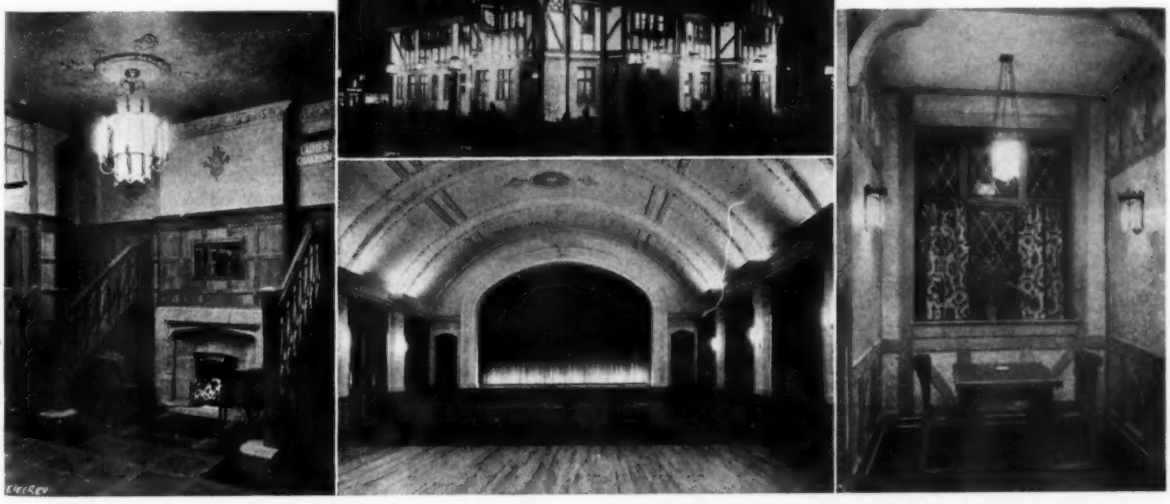
London, S.W.1, *January 3rd.*

The Ironmongers' Claim

Since your new attitude towards electrical ironmongers' aspirations to direct representation on the Fair Trading Council is so unfavourable, I realise that there is little to be gained by continuing this correspondence. However, I cannot accept your suggestion that I "misunderstood" the editorial note in your issue of August 9th. You wrote:—

> "Whether they (the representatives of the E.C.A.) were right in protesting against the ironmongers' admission to the Council in view of the facts of the situation, is a matter of opinion, of course. But, after all, one must remember that it is an *Electrical* Fair Trading Council."

If I, in common with many other electrical ironmongers, was totally mistaken in putting the obvious construction on these two sentences, I should like to know what they really did mean. Otherwise, Sir, we are simply forced to the conclusion that you have changed your mind.



The new Daylight Inn, Petts Wood, which owes its name to Willett, the advocate of daylight saving, who was born in the district, presents a very welcoming appearance at night illuminated by "Sieray" floodlights. Tubular heaters are employed both in the saloon bar, of which an alcove is shown (right), and in the dance hall (centre), where they are concealed behind grilles in the skirting. Specially designed pendant lighting fittings are used in the entrance hall (left), where a "Magicoal" fire is also to be seen. **(Note on page 70)**

Your remarks concerning electrical contractors and a wireless section of the E.C.A. merely sidetrack the point I raised. If the electrical industry wants not more organisations but fewer, let wireless members of the E.C.A. join the Wireless Retailers' Association instead of starting their own wireless body; and if electrical contractors are entitled, as you say, to wireless recognition because they were the first wireless dealers, then it follows that we are equally entitled to electrical recognition because ironmongers were the first electrical retailers.

E. B. HOLLOWAY,
Hon. Sec., Electrical Section, Ironmongers' Federated
Cradley, *December 31st.* Association.

[When we stressed the fact that the Council was an *Electrical* Fair Trading Council we meant that it comprised representatives of the Associations in the *electrical* industry, and we still think that these are sufficient in number for that industry. —EDS., ELEC. REV.]

Earth Resistances

The leaderette in your issue of January 3rd reminds me of a point raised about eleven years ago in connection with a telephone trunk cable scheme. Few then appreciated the necessity for bearing in mind the difference between a point being earthed and being at earth potential.

In order to obtain mathematical precision with capacity measurements and thus obtain in practice a cable with a cut-off frequency of 60 kilo-cycles (giving twelve channel circuits per pair of wires) this difference must be considered during manufacture and laying. If the anticipations of the trunk cable designers are to be met it will be necessary to consider fluctuations in atmospheric pressure, humidity and temperature during laying.

From personal experience on power contracts, where it is found that even the fact that trees grow is overlooked, and from hearsay at the Institution meetings I have often noticed the lack of co-ordination between the different branches of the electrical industry. One branch is continually starting anew to investigate points which have already been thoroughly thrashed out by another. Thus, radio manufacturers have spent thousands of pounds on learning lessons about switches instead of profiting by telephone engineers' experience. Telephone and radio engineers have already found out that it is possible to design so that the results will not fluctuate with natural causes, including the human element.

W. PENSTONE.

London, E.10, *January 4th.*

A Long-lived Dynamo

We have now in our stores a Crompton overtype Gramme wound dynamo (No. 3084, 110 V, 20 A, 1,580 r.p.m.) made about 1890. This was converted to carbon brush gear 25 years ago and has a cast brass trade mark of Crompton and was lubricated with drip feed glass lubricators.

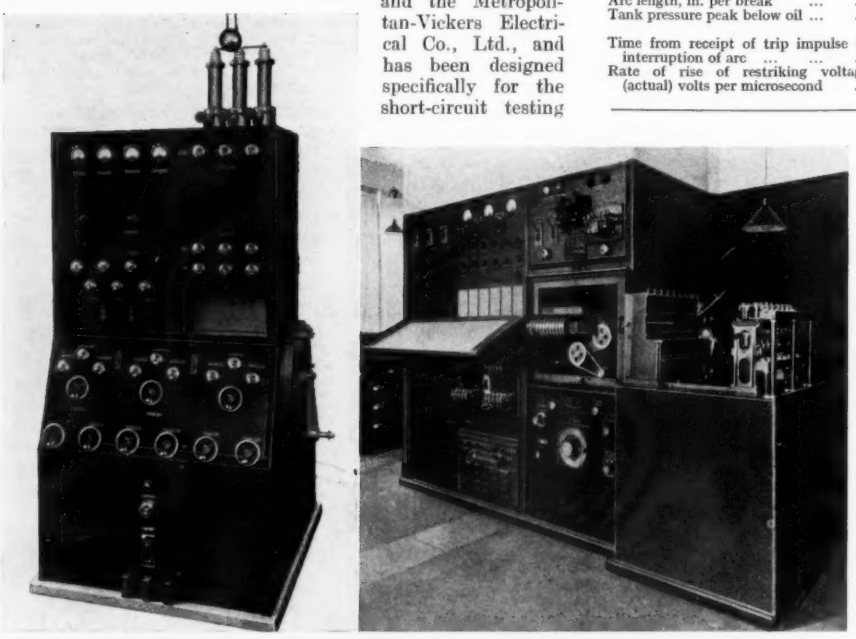
It is truly an example of British workmanship good after 45 years' work, and we should like to present it to one of the polytechnics or technical colleges of the country.

BUCHANAN & CURWEN, LTD.,
Albert N. Morris,
Leatherhead, *December 31st.* *Director.*

New Switchgear Testing Plant

A 1,500,000 kVA generator

THE constituent companies of Associated Electrical Industries, Ltd., have hitherto carried out routine short-circuit tests with the aid of available generators of their own manufacture; they have also had ready access to short-circuit testing plants both on the Continent and in the U.S.A. To meet increasing demands for more and larger sets and to provide for technical and engineering developments in this country their existing facilities have now been augmented by a complete testing plant erected by a new company, the Switchgear Testing Co., Ltd. This company's plant, situated at Mosley Road, Trafford Park, Manchester, is jointly owned by the British Thomson-Houston Co., Ltd., Ferguson Pailin, Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., and has been designed specifically for the short-circuit testing of all types and sizes of switchgear to almost any degree of severity. The complete plant was designed by a committee drawn from the three companies, and the whole of the apparatus, including the 1,500,000 kVA 11-kV generator, 780,000-kVA bank of 11/132-kV transformers and oscillographs, was made in their factories and research departments.



Three-element cathode-ray, and (right) sixteen-element electro-magnetic oscillographs

The oscillographic equipment gives a complete and accurate record of the behaviour of a circuit-breaker for the period during which a short circuit exists, and may produce evidence sufficient to condemn a breaker that has operated without external signs of distress. It comprises both electro-magnetic and cathode-ray instruments. The electro-magnetic oscillograph enables no fewer than sixteen records to be taken simultaneously on one film, thus obviating the difficult co-relation of records taken on separate films. The duty of the cathode-ray oscillograph is to record the high-frequency transient restriking voltage which occurs at the instant of interruption of the arc, recent research having shown circuit-breaker performance to be appreciably affected by the nature of this transient The instrument makes three simultaneous records on a single moving film whose velocity during exposure is approximately 90 m.p.h.

		Phase		
		R	Y	B
Phase-to-phase voltage before tests ...	67,200	—	—	—
Phase-to-phase recovery voltage after test	54,500	—	—	—
Peak current in maximum loop (66 kV.)	—	10,100	15,500	11,700
R.m.s. initial current in short	—	6,010	9,250	6,830
R.m.s. initial current in arc	—	5,700	7,830	5,700
Phase recovery voltage	—	30,800	30,900	31,900
MVA interrupted (by BSS.116) ...	600	—	—	—
Arc duration in half-cycles	—	6.1	5.4	6.8
Arc length, in. per break	8.6	—	—	—
Tank pressure peak below oil	54 lb. per sq. in.	—	—	—
Time from receipt of trip impulse to interruption of arc	5.3 cycles	—	—	—
Rate of rise of restriking voltage (actual) volts per microsecond ...	—	2,100	2,600	2,400

Values obtained from oscillograms when a 66-kV oil circuit-breaker was tested on a make-break cycle on a 600 MVA short circuit are shown in the accompanying table. The records were taken in less than 0.2 sec.

The rate of rise of restriking voltage shows the circuit conditions to have been severe, but despite this the short-circuit was cleared in 5.3 cycles. The tank pressure generated was quite small, being only a fraction of that which the tank was designed to withstand.

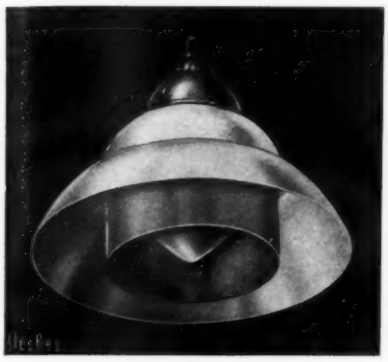
A further record is obtained by a cine camera which is automatically brought into action when a test starts. The information collected from each test thus comprises sixteen general records, three records dealing with the high-frequency restriking voltage transient and one visual record.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Diffused Lighting Without Glare

The "Wundalite" fitting, a new lighting unit just put on the market by MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2, has been specially designed to direct the main illumination into the working plane. An opal outer shade diffuses the upward rays so that rings of light on the ceiling are avoided.



The Hawkins "Wundalite"

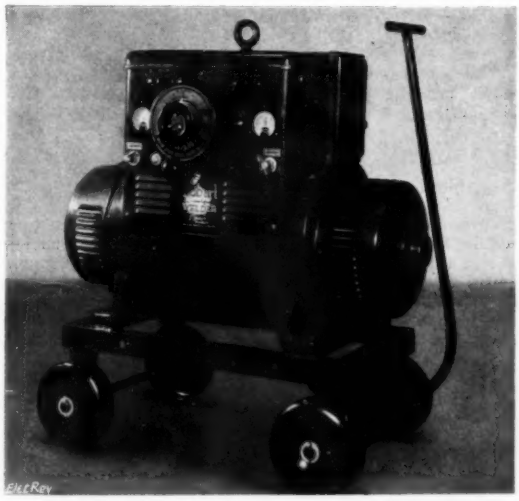
The light rays reflected downwards give a powerful illumination which passes through an inner ring and cone made (in one piece) of crystal obscured glass. This is fitted at the correct distance from the light source, absorbing less light than opal or opal-cased glass and giving good diffusion without any glare. The inner glass cone is easily removable for cleaning.

Tests of the "Wundalite," employing a 150-W lamp, are said to have given 13.5 ft.-candles illumination compared with 8.5 ft. candles for an ordinary opal enclosed unit. Its efficiency is estimated at as high as 83 per cent.

Two sizes are available, suitable for 200-W and 75-W lamps respectively. Though their applications are unlimited, the smaller model will undoubtedly find favour for bathroom and kitchen use.

Cotton Loom Motors

For the driving of cotton looms, particularly individually in new mills, the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has recently introduced a comprehensive range of motors and switches. There are five standard sizes of squirrel-cage motors, with ratings from ½ to 2 h.p. at 1,000 r.p.m. and from ½ to 1½ h.p. at 750 r.p.m. The temperature rise of the windings and core does not exceed 35 deg. C. after six hours running on full load, and the steel shaft is suitable for belt, V-belt, chain, or gear drive. For chain or V-belt drives the motors are provided with feet for floor or frame fixing, while for belt drives the motor is mounted on a spring base so that the correct tension is maintained; slots in the base-plate facilitate belt adjustments. The cast-iron frame and end brackets are machined to ensure dust-tight joints; ball bearings are employed; and the terminal box, which is fitted with a dust-tight cover, is situated on top of the stator frame and drilled to allow incoming cables to be brought to either end, the unused hole being fitted with a plug.



The "Hobart" welder

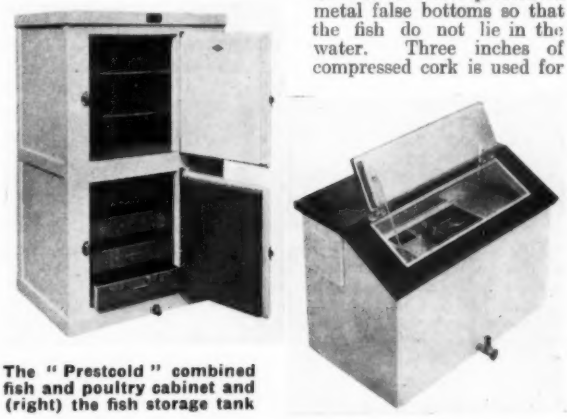
The associated switches are of the controller type with two contacts per phase, working in either a horizontal or vertical position. They are usually operated by the starting lever of the loom, but an ordinary handle can be fitted at either end of the case. The complete switch is enclosed in a cast-iron case with a hinged cover fitted with a gasket.

A Rubber Mallet

The "Rallit" is a new rubber mallet made by HENLEY'S TYRE AND RUBBER CO., LTD., 20, Christopher Street, London, E.C.2. It is said to be perfectly balanced and, it is claimed, will do everything that a wooden mallet will do and do it better and more quickly, besides lasting longer. The tough and resilient rubber head is fixed so that it cannot come off. The weight is 1¾ lb. with a sprayed tubular steel handle.

Storing Fish and Poultry

Cold cabinets have been designed by the PRESSED STEEL CO., LTD., Cowley, Oxford, for storing wet fish and either poultry or dry fish in the same cabinet. The top compartment has a frost coil to produce the dry cold atmosphere required for storing poultry, while in the lower tank there are galvanised iron drawers, a brine tank being used to provide damp cold. This compartment has a dished watertight cement floor, with an outlet pipe having a cone fitting for connection to a hose. The drawers have perforated metal false bottoms so that the fish do not lie in the water. Three inches of compressed cork is used for heat insulation, and the doors are lined outside and inside with "Marboliron."



The "Prestcold" combined fish and poultry cabinet and (right) the fish storage tank

Two sizes are available, the smaller having a dry storage space of 27 cu. ft. and wet storage capacity of 36 stone, and the larger with capacities of 49 cu. ft. and 72 stone. They are operated by ¼ and ½ h.p. motors respectively.

There is also a new storage tank for the dealer in wet fish, including shellfish. It is designed so that it may be used equally well for storing a variety of fish on separate shelves or, by removing all shelves, for storing one kind in bulk. The "Junior" size holds 50 to 60 stone of fish and the "Senior" 120 stone.

A Portable Welder

The new "Hobart" welder introduced by FREDERICK J. GORDON & CO., LTD., 114-116, Euston Road, London, N.W.1, is a portable unit designed for light operations, such as sheet-steel working and small engineering. The output is 100 A with a welding range of from 25 to 125 A at 25 V.

It is fitted with remote control and can be supplied with or without a trolley.

Lampshade Developments

Hand-painted "Seloid" lampshades with embossed designs, now obtainable from MESSRS. CHARLES SELZ, 47, New Cavendish Street, London, W.1, are particularly suitable for use with lalique vases. The pastel colours used depict birds, flowers, leaves and conventional geometric designs. Embossed designs are also employed for an attractive range of pendants. Canvas on parchment is a new combination which lends itself well for table-lamp shades, while a mushroom-shaped shade with a stand in the form of a tassel is another recent product. The showrooms at the above address also contain a large selection of novel table lamps of dainty design.

Testing Armatures

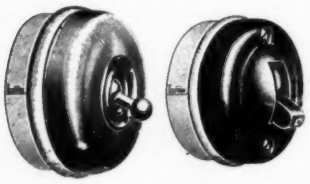
For armature fault finding the "Runbaken Varitone" tester operates on a system of induction. A magnetic field is created with a frequency of about 50 cycles per second; this induces a current in the armature winding only if a short-circuit or partial short-circuit exists. Under these conditions the core of the armature itself becomes magnetised near the fault. This induces, in turn, a current into the fault tracer which is connected to a pair of headphones. No sound occurs as the armature is slowly rotated until a faulty place is reached.

Open circuits are found by shorting each commutator bar in turn when the absence of sound in the headphones would indicate a breakage. The tester may be used on either d.c., a.c. or battery supplies, and is claimed by the makers, ELECTRICAL AND AUTO PRODUCTS (1931), LTD., 280, Deansgate, Manchester, 3, to be simpler, quicker and more accurate than a growler or drop-test.

D

Improved Switches

An improved range of "London" underslung switches is being made by MESSRS. A. P. LUNDBERG & SONS, LTD., 477-489, Liverpool Road, Holloway, London, N.7. They are rated to 5 A at 250 V, and are obtainable in surface, semi-recessed, and flush patterns. These switches, specimens of which we have examined, are robustly constructed of porcelain, and are fitted either with polished brass or bakelite covers and knobs. Single and two-way types are available, and a strong quick make-and-break action is incorporated.



The "London" and "London Junior" switches

The "London Junior" is a smaller and lower-priced range with the same rating and incorporating a q. m. and b. with blade contacts and "one piece" double-leaf contact springs. These have vitreous porcelain bases with bakelite knobs, covers and fronts.

A Maximum Demand Alarm Relay

The usual type of maximum demand indicator which is operated on a half-hour basis does not safeguard against unusually heavy demands. Assuming the normal maximum to be 1,000 kW and that, due to unforeseen circumstances, this is increased for a short time to 1,250 kW, then if this increased demand should commence at the beginning of a 30-minute period, 24 minutes of the 30 would have to elapse before the m.d. indicator could show any increase, when it would be necessary to cut off the load entirely to effect a saving. It is to overcome this deficiency that a new m.d. alarm relay has been developed by MESSRS. FERRANTI, LTD., Hollinwood.

It is operated by contacts from a watthour meter in a manner similar to the usual type of impulse demand indicator. Thus, the indicated demand bears a correct relationship to the load, whether or not the circuit is three- or four-wire and the load is balanced. An alarm pointer for the inner scale may be adjusted to any predetermined demand figure. If, during any ten minute period, the demand is such that its continuance for 30 minutes, or for the normal demand period prescribed, would cause the set figure to be exceeded, alarm contacts on the setting and driving pointers are closed. These contacts are capable of dealing with 40 W on a non-inductive load and are suitable for operating a separate visible or audible alarm device. Excessive loads continuing for more than ten minutes are therefore detected automatically; generally a small reduction in the load will serve to limit the 30 minute demand so that a considerable saving on the m.d. charge may be effected.

The Ferranti maximum demand alarm relay

In the accompanying illustration the pointers are shown in a clockwise order from the bottom position, they are, respectively, driving pointer, alarm setting pointer, demand indicator and hand reset for the demand indicator. The self-contained time element is of the self-starting, synchronous motor type for 50-cycle operation. The overall dimensions of the instrument are 9¼ in. dia. by 5$\frac{1}{16}$ in. deep.

An Installation Rent Collector

A large proportion of the domestic equipment in use to-day is obtained from the supply company on hire or hire-purchase terms, and while, as a rule, the cost is met by an increase in the price of electricity paid through a single meter, this method can give the consumer the impression that he is paying too much for energy consumed during the summer quarters.

Because of this a rent collector has been designed by BRITISH INSULATED CABLES, LTD., Prescot, Lancs, allowing the collection of a fixed sum per week independently of the ordinary meter. In the event of the non-payment of instalments the supply is cut off until the arrears are made up; the motor, however, continues to run, the amount of arrears being indicated in red on the dial. When the hire-purchase charge has been paid the rent collector may be removed from the premises. Another use for the apparatus is for the collection of a fixed charge under a two-part tariff, in addition to any hire-purchase charge.

The instrument consists of a standard B.I. prepayment meter mechanism with the addition of a constant speed self-starting motor drive totally enclosed in a stove-enamelled pressed steel case.

Electrical Instruments

The Hartmann & Braun luminous-pointer, moving-coil milliammeter for checking the microphone currents of radio and sound-film apparatus, designed for an oscillating period of only 0.02 sec. for half the scale length and aperiodically damped, is claimed to be capable of following the rapidly fluctuating speech currents instantaneously and to comply with the recommendations of the International Radio Society. The movement and luminous pointer are incorporated in a dull black-enamelled, edge-wise pattern case suitable for flush-mounting in switchboards or control desks. The instrument can, however, be used as a desk unit.

The 200-mm. scale is marked 0 to 10 (equivalent to a d.c. of 0-3 mA), and is translucent. The first 2 per cent. of the scale divisions are indicated in yellow, and the last 10 per cent. in red. The luminous pointer is sharply defined against the scale background. The moving-coil has an internal resistance of 170 ohms and a large external limiting resistance to permit direct connection in the anode circuit of a set of valves.

The "Multavi II" volt-ammeter

Light for the luminous pointer is provided by a 6-V lamp fed from the mains by a small built-in transformer. Connection to the microphone circuit and to the mains is effected by two-pin plugs recessed laterally in the case. The range is 3mA, and its overall dimensions are approximately 3½ by 10⅝ by 11⅝ in.

The instrument is being introduced into this country by the KANDEM ELECTRICAL LTD., 711, Fulham Road, S.W.6, together with certain other H. & B. productions. One of these is the "Ponavi" slider-type resistance measuring bridge, in which the bridge, galvanometer and dry battery are incorporated in one insulated casing measuring 8 in. by 4¼ in. by 3⅜ in. The range is from 0.05 to 50,000 ohms.

A second newcomer introduced by this company is the "Multavi II" volt-ammeter, which incorporates a metal rectifier for making a.c. measurements with the moving-coil system, as well as d.c. movements. The dimensions are 7 in. by 3¼ in. by 2⅜ in., and its weight is 2¼ lb. The current range is in six steps, from 0.003 to 6 A, and the voltage range, in five steps, from 6 to 600 V. A third is the "Monavi III" moving-coil d.c. pocket measuring instrument for d.c. (100 mV, 1 mA) and an internal resistance of 100 ohms; it acts as an ammeter up to 100 A with separate shunts, as a voltmeter up to 300 V with separate series resistance, and as an ohmmeter.

Bench Grinders

The latest developments by ROTAX, LTD., Willesden Junction, London, N.W.10, are two ball-bearing bench grinders. The 6-in. model is suitable for tool sharpening, light grinding, polishing and wire brushing in the workshop or garage. Wheel guards and adjustable tool rests are provided, and the machine is supported on rubber feet to prevent slipping, and, although provision is made for fixing, no bolting down is necessary for ordinary use on the bench. Where no convenient bench is available, the grinder can be mounted on a special pedestal provided by the makers.

The motor is of the totally enclosed ball-bearing type and can be supplied wound for frequencies of from 25 to 60 cycles giving no-load speeds of from 1,500/3,600 r.p.m., or for direct current giving a speed of 3,000 r.p.m. These speeds apply also to the 7-in. model, but in addition to its larger size it incorporates many refinements. For instance, eye-shields of safety glass are fitted and the tool rests are adjustable to compensate for wheel wear. The wheel guards, which are made to accommodate wire wheel brushes are of the enclosed type with removable end covers, and can be easily adjusted to enable grinding or wire brushing operations to be carried out on the circumference of the wheel.

The "Rotax" 6-in. grinder

Graphs for the Retail Trader. By T. W. Fazakerley, A.I.I.A.

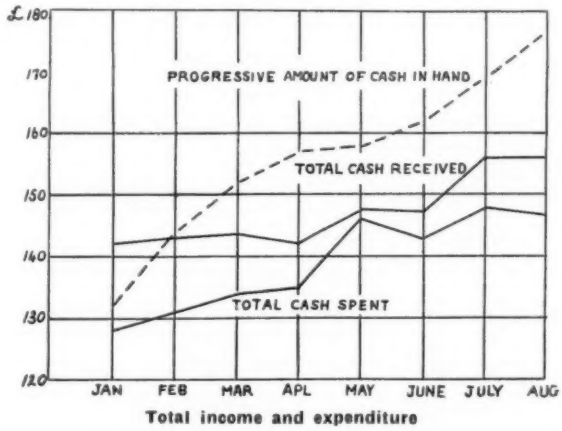
The need for quick reference

IN all trades it is essential for the shop-owner or manager to be able to refer quickly to figures that show him his stock, turnover and working-capital figures, but it is a necessity which, although generally understood, is not easy to meet. Books must be kept, of course; without them the business side of the trade becomes chaotic, and it need hardly be said that it is not sufficient to rely on bank statements or pass-books. These show the actual cash banked and the payments made, but a daily cash-book, credit-journal and other account books should not only be kept, but should be maintained rigidly up to date. There is a tendency with small traders, in particular, to be slack with their accounts, and while this article is not primarily intended to deal with accounting methods I feel it necessary to emphasise the advantages of well-kept books.

It might be claimed that with up-to-date accounts all the necessary figures for reference are at hand, but this is true only up to a point. It is impossible to get a comparison of one month's trading with the previous month's, or that of the corresponding month of the previous year, without a laborious and time-wasting search of the books. In this respect the value of graphs has been tried by go-ahead traders, and has been found considerable. They are the trader's ready-reckoner. At a glance he can tell exactly where he stands in turnover, working capital, gross and net profits and stock, all of which are essential factors in trading.

Some Special Advantages

Before dealing more fully with general graphs to show trading figures several advantages of particular use to the electrical trader can be briefly reviewed. The trader's stock can be roughly divided into three parts: (a) Small replacement parts which vary in value up to 1s. or 1s. 6d.; (b) larger replacement parts and small or low-priced new goods ranging, say, up to 20s.; and (c) new goods at prices limited by the trader's particular requirements. It is assumed that all sales will be entered either in the day-book or on the



Total income and expenditure

cash register, and at the end of the day's trading it is a matter of a few minutes only to total up the value of the sales under the three categories mentioned above.

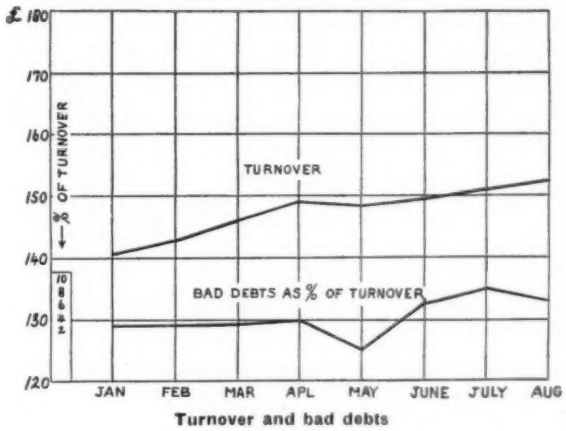
If required, of course, the limits suggested above can be widened; the trader will decide for himself what limits are likely to be of greater use to him. The graph in this instance can be daily or weekly, and from it the variation in turnover can be judged at a glance. Thus the trader will know whether his small stock is moving as it should do, and so on. The graph will show whether it is necessary to circularise or advertise in order to stimulate trade; or, if the trade is satisfactory, it will be a sound guide to the amount of stock that should be carried.

The major benefit of graphs, however, will be found in the following sections of retail trade: (1) Working capital, (2) expenses, (3) turnover, and (4) bad debts. It is generally accepted that if the position as regards these factors is healthy the business is flourishing—and, by flourishing, I mean improving. The degree of turnover increase must, of course, be governed by the neighbourhood and surrounding circumstances, but in a busy market position there is positively no limit to trade improvement. It will readily be seen that graphs showing the cumulative figures in the four sections mentioned will be of inestimable advantage.

If either (2) or (4) show any substantial increase the graph will indicate this immediately, thus enabling the trader to take immediate steps to rectify the trouble. If the other two items do not steadily increase (although the increase will not necessarily be seen weekly, it should certainly reveal itself quarterly) it can be observed immediately that trade is becoming stagnant, and advertising or other methods of trade stimulation should be developed. It can be emphasised again that graphs, showing the position at a glance, enable the retailer to take steps before any serious falling-off or stagnation can come about.

Working Capital

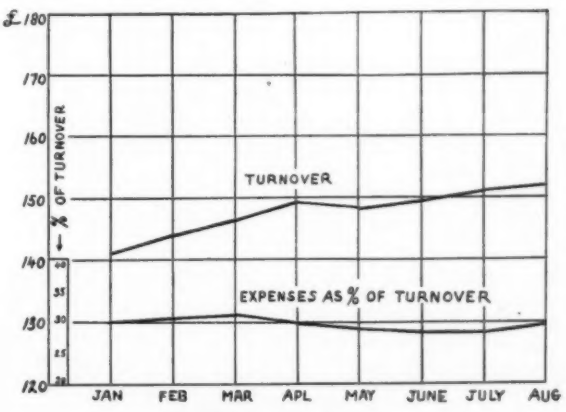
Stock position, and therefore turnover, is governed by working capital, which is, of course, of primary importance. This capital will—or should—increase week by week, and a properly prepared graph will show the position clearly. It is



Turnover and bad debts

essential, of course, for the trader to realise the limits of his working capital, but, providing these are realised, comparatively small capital need not restrict his trading prospects. It does, of course, demand a careful watch upon buying, care not to buy heavy stocks that might lie idle and become, for a long time, "dead" money, and it makes it necessary to depend in some measure on wholesaler's or factor's credit. But, providing the retailer never commits himself to purchases that cannot be paid for over a normal month (or three months, according to the length of his credit), this reliance on credit is not a liability.

The trader's expenses can be divided under two sections, variable and fixed. He will be well advised to analyse these expenses at the beginning of each trading year and, with variable expenses, review them at the end of each quarter. A small graph showing the cumulative expenses would be an advantage. It should be remembered that variable expenses frequently increase at a time of stagnant trading, for the trader will obviously have to spend money to stimulate trade, and thus advertising and circularising expenses go up. These expenses can be summarised thus: Fixed expenses cover rent, rates, salaries and maintenance, while variable expenses



Turnover and expenses
(Expenses cover all costs exclusive of actual purchases)

comprise advertising, circularising, stock depreciation, taxes and bad debts.

A certain number of bad debts are unavoidable, particularly at a time when the customer's purchasing power may vary

from, almost, month to month, bad debts are difficult to handle, particularly in the electrical trade. The introduction of credit accounts and gradual payment has, of course, stimulated trade considerably, but the number of cases in which the collection of payments is difficult is deplorable. It is of little use to the trader to know that his customer is the victim of circumstances and that he would pay if he could. On the other hand, no trader is intentionally harsh in his dealing with slow payers. He suffers financially, but it is to his eventual advantage to show leniency up to a point. The difficulty is to decide when this point is reached, and while it will be governed partly by his knowledge of the customer's circumstances, and partly by the length of time the customer has been on the books, it is necessary to have some hard and fast rule.

In this respect a graph serves as a guide. The trader will allow a certain figure for bad debts in his quarterly analysis, and then, by watching the graph, will know immediately when this figure has been exceeded. At that point he should take steps to recover outstanding accounts, and should generally tighten up his credit trade. If the figure is not exceeded, however, he can safely continue to show leniency and encourage credit trade, for the figure he has allowed means that he is making sufficient profit to cover himself against bad debts.

Turnover

I have already mentioned that turnover is dependent in a large degree on working capital and stock, and it may seem unnecessary to add that turnover itself is of vital importance in the retailer's business because it governs the amount of profit possible.

Unfortunately, the electrical trade, among others, finds it necessary continually to increase turnover in order to maintain a sound profit. Comparatively low margins of profit cause this, although it can easily be understood that widely advertised goods cannot yield so big a margin as non-proprietary lines. The retailer indirectly bears a certain amount of the cost of national advertising inasmuch as his profit is low. On the other hand, the well-advertised article does command a substantial sale, while its reliability guarantee is a matter for the maker, not the retailer. Nevertheless, there is a definite tendency towards lowering the margin of profit, thus making better turnover figures essential and forcing the retailer to consider every possible means of improving his trade.

Probably in this respect the use of graphs is of more importance than any other method. A chart on the lines illustrated will show at a glance the turnover figures during any required period, and any decrease not explained by seasonal trade, bank holidays or other known cause is seen at once. As with the other items, knowing at once when there is a decline or stagnation is a vital factor, and the position can be remedied by immediate action governed by the trader's particular circumstances.

Compare the graph system with that of the more usual method of waiting until a quarterly or half-yearly inspection of books with its laborious figure-work or the even less satisfactory method of waiting until the fault becomes obvious, and its advantages will readily be seen.

Credit Trade

I have said that credit trade is growing considerably despite the fact of its unreliability. I have examined the books of many traders who are in difficulties, to find that credit accounts have literally drowned the business. The money is owing, but money due will not meet accounts overdue. A certain set limit should be made for credit, and in no circumstances should it be extended unless the working capital increase warrants it. It is perhaps necessary to add that in many items the goods can be supplied on the gradual-payment system through the manufacturer, and when the trader's credit limit has been reached this is the wiser plan. It is admitted, of course, that the trader gets a much smaller profit when acting as agent in an instalment purchase, but a small profit in this case is better than a loss.

The British Industries Fair, 1936

A satisfactory increase in the number of Birmingham exhibitors

AS we have already reported, the London and Castle Bromwich Sections of the British Industries Fair are again being held simultaneously this year, from February 17th to 28th, last year's experiment of having the Birmingham Section in May not apparently meriting repetition. Although the list of exhibitors of electrical and allied products in the London Section (published in our November 29th issue, page 756) is rather shorter than that for 1935, the impressive list below of those who have booked space at Castle Bromwich more than compensates for this. The name of the British Electrical Development Association appears in the list, as usual. The Association is again arranging a kiosk and information bureau in the Electrical Section and is preparing a guide to this section for the use of visitors.

Acme Wringers, Ltd.
Agro Electrical Co., Ltd.
Aladdin Industries, Ltd.

Babcock & Wilcox, Ltd.
Bakelite, Ltd.
Baldwins, Ltd.
Batteries, Ltd.
Belling & Co., Ltd.
Belling & Lee, Ltd.
B.E.N. Patents, Ltd.
Berry's Electric, Ltd.
Birkbys, Ltd.
Birmingham Electric Supply Dept.
Birmingham Electric Manufacturing Co.
Black & Decker, Ltd.
Bowker, S. O., Ltd.
Bray, George, & Co., Ltd.
Britannia Batteries, Ltd.
Britannia Tube Co., Ltd.
Britannia Electric Lamp Works (1934), Ltd.
British Electric Meters, Ltd.
British Electrical Development Association
British Oxygen Co., Ltd.
British Sangamo Co., Ltd.
British Thomson-Houston Co., Ltd.
British Trane Co., Ltd.
Bulpitt & Sons, Ltd.
Burnley Components, Ltd.

Cable and Wireless, Ltd.
Cable Makers' Association
Canning, W., & Co., Ltd.
Capaswitch Co.
Carron Company
Cellon, Ltd.
Chloride Electrical Storage Co., Ltd.
Clear Hooters, Ltd.
Concordia Elec. Safety Lamp Co., Ltd.
Consolidated Pneumatic Tool Co., Ltd.

Dalyte Electrical Co.
Desoutter Bros., Ltd.
Donovan Electrical Co., Ltd.
Dubilier Condenser Co. (1925), Ltd.
Duro-Glass Works, Ltd.
Duro-Ray, Ltd.

Earle, Bourne & Co., Ltd.
Eaves, Thos., Ltd.
Electric Radiators, Ltd.
Electrona Electrical Products, Ltd.
Elliott, E.
Enfield Rolling Mills, Ltd.
English Electric Co., Ltd.
Ether, Ltd.
Evershed & Vignoles, Ltd.

Falkirk Iron Co., Ltd.
Ferranti, Ltd.
Flextol Engineering Co., Ltd.
French, W. T., & Son

General Electric Co., Ltd.
Gent & Co., Ltd.
George, W. & J., Ltd.
Gilman, F. (B.S.T.), Ltd.
Gledhill Brook Time Recorders, Ltd.
Gordon, James, & Co., Ltd.
Greenwood & Batley, Ltd.
Guest, Keen & Nettlefolds, Ltd.
G.W.B. Electric Furnaces, Ltd.

Hague & McKenzie, Ltd.
Hailwood & Ackroyd, Ltd.
Hawkes, O. C., Ltd.
Hawkins, L. G., & Co., Ltd.
Higgs Motors, Ltd.
Holden & Hunt
Hope's Heating and Lighting, Ltd.
Hotpoint Electric Appliance Co., Ltd.

Ioco Rubber and Waterproofing Co., Ltd.
Ismay, John, (Rawson), Ltd.

Jackson Electric Stove Co., Ltd.
Johnson Matthey & Co., Ltd.
Johnson, Richard, & Nephew, Ltd.

Klaxon, Ltd.

Leda Electric, Ltd.
Lister, R. A., & Co., Ltd.
London Aluminium Co., Ltd.
London Electric Wire Co. & Smiths, Ltd.
Lucas, Joseph, Ltd.

M. & C. Switchgear, Ltd.
Macpherson, Donald, & Co., Ltd.
Martindale Electric Co., Ltd.
Mavitta Drafting Machines, Ltd.
M.C.L. and Repetition, Ltd.
Midland Fan Co., Ltd.
Midland Metal Spinning Co., Ltd.
Mirrlees, Bickerton & Day, Ltd.
Mirrlees-Watson Co., Ltd.
Moffats, Ltd.
Moorwoods, Ltd.
Morrison, A. E., & Sons, Ltd.
Moulded Products, Ltd.

Neill, J., & Co. (Sheffield), Ltd.
Neon (Excelda) Co.

Orme, Evans & Co., Ltd.

Parsons, C. H., Ltd.
P.B. Sillimanite Co., Ltd.
P. H. British Electrical Works, Ltd.
Pinchin, Johnson & Co., Ltd.
Pressed Steel Co. (G.B.), Ltd.

Radiovisor Parent, Ltd.
Rapid Magnetting Machine Co., Ltd.
Rawlplug Co., Ltd.
Revo Electric Co., Ltd.
Rheostatic Co., Ltd.
Richardson, H. G., Sons, Ltd.

Sanders, Wm., & Co. (Wednesbury), Ltd.
Sankey, Joseph, & Sons, Ltd.
Simplex Electric Co., Ltd.
Skylux, Ltd.
Smith, Frederick, & Co.
Smith Meters, Ltd.
Soutter, Henry R., Ltd.
Steiner, I. & M., Ltd.
Stone, J. B., & Co., Ltd.
Streetly Mnfg. Co., Ltd.
Sun-Vic Controls, Ltd.
Supremus Specialities, Ltd.

Taylor & Backhouse
Tecalemit, Ltd.
Telegraph Construction & Maintenance Co., Ltd.
Telephone Mnfg. Co., Ltd.
T.M.C. Harwell (Sales), Ltd.
Tok Switches, Ltd.
Tube Products, Ltd.
Tubes, Ltd.
Tucker, J. H., & Co., Ltd.

Walsall Conduits, Ltd.
Webb's Crystal Glass Co., Ltd.
Westinghouse Brake & Signal Co., Ltd.
Whitecross Co., Ltd.
Wiggin, Henry, & Co., Ltd.
Wild-Barfield Elec. Furnaces, Ltd.
Wolf, S., & Co., Ltd.

Materials for the Electrical Industry

Retrospect and Prospect

The movements of prices during the past year of some of the most important materials used in the electrical industry are dealt with in the following notes provided by the Metal Information Bureau, Ltd. Political and economic factors which are likely to influence production and prices in the near future are also reviewed.

Copper

DURING 1935 there was a very material improvement in the copper position, which, whilst owing its origin fundamentally to a considerable broadening in consumption, was helped by an output restriction scheme agreed to by certain important producing countries, mainly the Belgian Congo, Rhodesia and Chile, resulting in a total curtailment of output of no less than 200,000 tons a year. Whilst the electrical industry in practically every country has made progress during the past twelve months, the mainstay of the expansion in copper consumption has been the building industry and the boom in armaments (including, of course, the Italo-Abyssinian war). Prices have recovered to a level which is moderately remunerative for the better-situated producers, and it is anticipated that during the coming year values may establish themselves on a slightly higher plane.

Germany has probably been the most disappointing market, efforts there to replace copper by aluminium having been intensified owing to currency difficulties. Indeed, a definite ban on the use of copper for certain types of high-pressure cables has been imposed. In the United States there has been a very welcome recovery in the quantity of electrical energy consumed during the last twelve months, but as this has been mostly in the nature of recapturing lost ground it has called for comparatively few new installations, and therefore, for a comparatively small consumption of copper, so that although the total absorption of the metal in America rose very considerably during 1935 it is very doubtful whether the electrical industry absorbed 50 per cent. of the total consumption, as it used to do. Prospects for electrical development in America during the coming year are regarded very hopefully.

There is no question of any scarcity of copper for a long while to come, and it is interesting to note that whilst producers are endeavouring to raise the price level a little higher, they are definitely opposed to creating conditions favouring a "runaway" market with its consequent disadvantages to consumers.

Lead

There was a remarkable improvement in the lead situation in 1935. Consumption expanded in almost every country and European demand assumed practically record proportions. There was a large reduction in stocks, and prices improved considerably, although the upward movement was overdone in October, and towards the end of the year the market was easier again. United Kingdom consumption was at the remarkable level of nearly 30,000 tons a month, and whilst the building industry was the biggest individual consumer, there was a very welcome revival in buying by the cable trade, stimulated by Post Office orders. Accumulator makers also had a busy year, largely owing to the favourable development of the motor-car industry.

The 10 per cent. duty on non-Empire lead which was found to have a depressing effect on prices was amended in August, a flat rate duty of 7s. 6d. per ton being substituted, with provision for Empire producers to receive a premium of 7s. 6d. per ton on all metal sold on the London Metal Exchange. The outlook for 1936 is regarded as favourable, as whilst there may be a decline in the building industry at some time in the future, informed opinion takes the view that this will not occur during 1936. Post Office orders for cables are expected to be maintained, whilst general electrical development is proceeding favourably, and the motor-car industry is looking forward to an even better year than in 1935.

Tin

There was an unexpectedly large increase in tin consumption during the second half of last year, the American motor-car and tinplate trades enjoying boom-like conditions, whilst European demand was also greater than it has been since 1929. The liquidation of the Buffer Pool stock was carried out in a way which gained it many critics, and at the moment the scheme seems unlikely to be renewed. What was of more importance, increases in quotas were delayed, so that in the latter half of the year production quotas had to be raised very rapidly, until they amounted to 80 per cent. of standard for the final quarter compared with 40 per cent. for the first quarter.

Even so very tight conditions obtained in the market for several months, and for the first quarter of 1936 quotas have been raised to 90 per cent. of standard which may result in tin output during the current year reaching a record level. Consumption prospects for 1936 are regarded as quite favourable, and whilst prices may conceivably recede somewhat from the high levels recently in force, it is unlikely that the International Tin Committee will allow them to fall very far.

Spelter

Whilst the demand for spelter both in Europe and in the United States showed distinct broadening during 1935, and prices on the whole were better than in 1934, the spelter market has been notable for a lack of confidence, and a tendency to drift in accordance with the general trend. Towards the end of the year negotiations were started for a revival of the International Zinc Cartel on terms more favourable to British producers, but agreement on this subject appears to be a long way off.

The outlook for 1936 seems a little drab unless the galvanising industry can recover more of its lost ground, and keep pace in a better fashion than it has done with its competitors. As in the case of lead the unpopular United Kingdom duties on foreign material were revised in August, the present basis being a flat-rate duty of 12s. 6d. per ton on foreign metal with a premium of a same amount payable on Empire spelter sold on the London Metal Exchange.

Aluminium

With its multifarious outlets aluminium benefited fully from the widespread trade revival during 1935. It was helped especially by the vigorous efforts in Germany to promote the use of aluminium at the expense of other imported metals, and German production and consumption expanded in a somewhat remarkable fashion. Business in the United States also improved rapidly, whilst in the United Kingdom there was a satisfactory increase in demand helped materially by the larger building programme of the Air Force.

Russian output increased substantially, whilst Japan began to manufacture aluminium on a commercial scale for the first time. The price was maintained steadily at £100 a ton for ingots, and at the moment there is nothing to indicate that the International Cartel will not be able to maintain its price structure during 1936.

Rubber

It cannot be said that 1935 was a particularly satisfactory year for rubber producers, since prices fluctuated between a low level of 5$\frac{3}{16}$d. and a top price of only 6$\frac{11}{16}$d. per lb., the highest figure occurring at the beginning of the year. Production certainly showed a heavy fall owing to the output restriction scheme, being probably 100,000 tons less than in 1934.

Consumption did not apparently improve to the extent anticipated, especially in the early months of the year, but the actual position was probably better than the published figures showed, since there was a steady diminution in "invisible" or consumers' stocks, and towards the end of the year this made itself felt, and reductions in the visible stocks increased until in November a fall of some 30,000 tons was recorded in one month.

The chief obstacle to a more satisfactory operation of the output restriction scheme has been the old one of the Dutch East Indies native output. However, the Dutch Government made serious efforts to put this matter straight, including the purchase of licences for 20,000 tons for cancellation, and it is hoped that during the coming year these measures will have fuller effect. Export restrictions have been tightened up, and at the moment it is anticipated that 1936 will see a further material reduction in the heavy stocks which should be accompanied by a gradual improvement in prices.

Whilst prices last year were definitely less disastrous than previously they offered little or no margin to even the best estates when the curtailment of output (inevitably increasing costs of production) was taken into account. The restriction scheme has now, it is believed, overcome the initial difficulties which seem inseparable from schemes of this kind, and is expected to operate more satisfactorily from now on.

Hydrogen and Oxygen Production in Canada

The Ontario Hydro-Electric Power Commission is establishing an experimental plant at Leaside, near Toronto, for the purpose of producing hydrogen and oxygen by electrolysis. It is hoped that if this process is successful Ontario's imports of coal for making gas will be halved.

Business and Industrial Notes

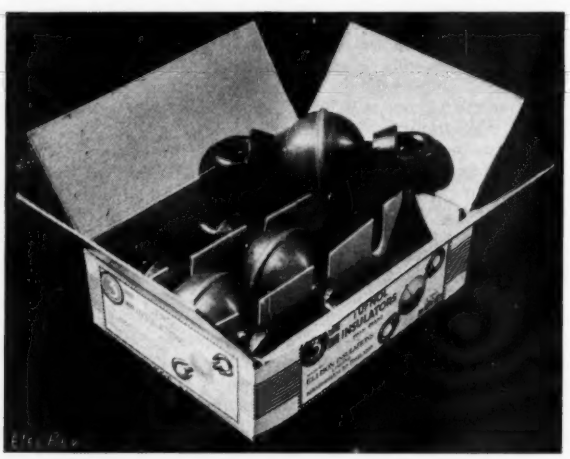
The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

A Shilling a Ton More for Coal

With a view to assisting the mining industry and avoiding the disaster of a strike the councils of the Incorporated Municipal Electrical Association and other electricity supply associations have recommended their members to agree voluntarily to pay a shilling a ton more for coal, representing a "gift" of £600,000 a year to the miners based on last year's consumption of 12,000,000 tons. Where contracts have been entered into since July 1st, 1935, at a higher price it is intended to offset the increase by the additional shilling payment now proposed. Among a number of safeguards it is stipulated that all the money accruing from the increased payment shall go to augment the miners' wages, the strike must be declared "off," and that there shall be no differentiation between competitive public utility undertakings and large industrial power users. Another condition is that the competitive position of the electricity supply industry shall not be prejudiced. The West Midlands Joint Electricity Authority decided last Friday to pay an extra shilling a ton on coal purchased under contracts expiring on March 31st next but not to pass on the increase to the supply authorities. Subject to the miners' acceptance at this week's meeting with the coal owners, the new rates will operate as from January 1st. The scheme is also sponsored by the Central Electricity Board.

Insulator Packing

Ellison Insulations, Ltd., has up to date found the packing of its "Tufnol" bell and ball insulators a difficult problem



A new packing for ball insulators (Ellison Insulations, Ltd.)

on account of their awkward shapes. It has now designed boxes which will accommodate six bell insulators or three ball insulators by using different inserts. The boxes are collapsible and the cardboard inserts are put in when the box is required. The total weight is in each case below 11 lb., so that supplies can be sent by post. The labels are of neat design in two colours, and are put on the boxes after packing. One of the boxes is shown in the accompanying picture.

The Skipton Showrooms

The new electricity showrooms of the Skipton Urban District Council were formally inaugurated on December 12th by Mr. M. H. Morris, chairman of the Electricity Committee. The showrooms are housed in an old building, which has been suitably reconstructed, in a central position in the town. It consists of a ground and first floor showrooms, the latter being arranged so that it can easily be converted into a suitable demonstration room. There is a further floor which can be utilised for special displays when necessary, whilst the Department's offices are also accommodated on the premises. The showroom stocks are housed in the basement and an outbuilding. In sending us these particulars and the photograph from which our picture is reproduced, Mr. W. V. Smythe, the electrical engineer, states that no simple hire is as yet contemplated, but appliances over £1 in value are sold on hire-purchase terms. There is also an "all-in" tariff, under which the "unit" charge has recently been reduced from ¾d. to ½d. In performing the opening ceremony Mr. Morris said the distributing station at the old Grammar School was opened in 1923, electricity being supplied by the Yorkshire Electric Power Co., and the number of consumers was fifty. To-day there were nine sub-stations with a capacity of 2,000 h.p. and there were 2,500 consumers. It was anticipated that the sales of electricity during the current year would exceed 2,000,000 kWh.

The new electricity showrooms of the Skipton Urban District Council

Electrical Radio Interference

Messrs. Ward & Goldstone, Ltd., inform us that in order to help electrical contractors, wireless traders and others to deal effectively with problems of electrical interference to radio reception, they employ a technical staff specially for this purpose and will give advice free of charge to those who may experience difficulties in this direction.

The Osram Lamp Works

The accompanying illustration shows the Osram Lamp Works, Wembley, of the General Electric Co., Ltd., which have recently been considerably extended. The present floor area is 290,000 sq. ft., as compared with 90,000 sq. ft. when the factory was first opened.

The Osram Lamp Works, Wembley, which have recently been extended

Christmas Displays at Hull

We have just received from Mr. J. N. Waite, general manager and engineer of the Hull Corporation electricity undertaking, photographs of a number of displays at the electricity showrooms which proved a great attraction during the Christmas shopping period. The one illustrated shows Santa Claus with his reindeer arriving with a varied supply of electrical gifts.

One of the Christmas displays at the Hull electricity showrooms

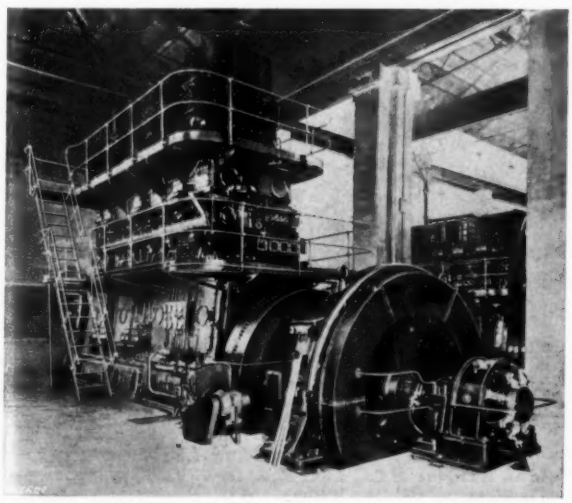
The Westinghouse Jubilee

On Wednesday last the Westinghouse Electric & Manufacturing Co. completed the first fifty years of its existence. At its original works in Pittsburgh, U.S.A., 200 men were employed; now in normal years over 40,000 people are engaged at nineteen works on products that range from steam turbines to lamps and domestic appliances. The company was from the outset an advocate of a.c., and installed the first commercial system of that kind in America at Buffalo, N.Y., in November, 1886. The contract for the lighting of the Chicago Exposition in 1893, which called for the use of 250,000 lamps, was awarded to the company, which exhibited a complete a.c. system including induction motors, first offered for commercial use in the following year.

In 1895 Westinghouse designed 5,000-h.p. generators (the largest then built) for the Niagara Falls contract, and these are still retained as standby. Steam turbines were first built by the company in 1899; the output was 400 kW, contrasted with the single-shaft 183,333-kVA unit made in 1935, which fills the space occupied by an earlier machine of one-third the capacity. Other notable pioneering works have been: 1888, a.c. meters; 1903, 50-kV transmission line; 1906, electrification of the N.Y., New Haven and Hartford Railway; 1908, mercury-arc rectifier; 1909, 140,000-V transmission and electrification of the Italian State Railways; 1915, Norfolk and Western Railway (hauling coal up heavy grades), and Pennsylvania-Paoli Railway; 1917, automatic sub-stations for traction; 1920, Diesel-electric drive for ships and radio broadcasting; 1923, de-ion circuit breakers; 1926, electric welding of buildings; 1929, Diesel-electric locomotives; 1931, electric propulsion of s.s. *Coolidge* (then the largest merchant ship built in America); 1934, N.Y.-Philadelphia Railway electrification; 1935, two 82,500-kVA waterwheel generators for Boulder Dam, mercury lighting for industry and sodium lighting for highways.

Orders Recently Booked

The English Electric Co., Ltd., has received an order from the Bermuda Electric Light, Power & Traction Co., Ltd., for a 3,500 b.h.p. mechanical injection, two-stroke cycle, pump scavenge, opposed piston, eight-cylinder Diesel engine, running at 214 r.p.m., directly coupled to an English Electric alternator. This contract, which has been obtained against keen Continental and American competition, is a repeat order, and will be the fifth Diesel engine of the English Electric Fullagar design installed in the Bermuda station, and will bring the total power to over 10,000 b.h.p. The new set will weigh approximately 275 tons. The engine will be manufactured at the company's Rugby works and the alternator at its Stafford works. The company claims that it will be the largest Diesel engine ever manufactured in Great Britain for industrial purposes, the 2,600-b.h.p. set installed by the English Electric Co. in Bermuda about three years ago being at that time also the largest Diesel engine built in this country for industrial purposes.



One of the Diesel engines which have been supplied to the Bermuda Electric Light and Power Co. by the English Electric Co., Ltd.

The Mirrlees-Watson Co., Ltd., has received a contract for the steam surface condensing plants in connection with the 50,000-kW sets being supplied by Messrs. C. A. Parsons & Co., Ltd., for the Glasgow Corporation's Dalmarnock power station. Each condenser will be complete with circulating pump, duplicate three-stage steam ejector air pumps, either of which will be capable of maintaining the vacuum at full load, and duplicate vertical spindle two-stage condensate pumps, either of which will be able to extract all the condensate at full load.

The Alton Battery Co., Ltd., informs us that it is to supply two batteries each of 25 cells with an ultimate capacity of 10,000 Ah for Paddington Exchange, this being the fourth Alton battery installation of this capacity employed on the Post Office telephone system. Batteries ranging in capacity from 200 to 1,000 Ah are also being installed at Wrexham, Ramsbottom, Waterlooville, Fulford, Boston, Farnham, Rugby, Sonning and Cleveley and in the Leeds area in Chapeltown and Roundhay Exchanges. All the power stations on the Galloway water power system are to be equipped with the company's batteries, as are the Building Research Station, Watford, and the Signals Experimental Establishment, Woolwich.

Contractors and the Register

At a recent meeting of the Council of the Electrical Contractors' Association the Director (Mr. L. C. Penwill) reported the formation of a committee to consider means of preventing overlapping between the Association and the National Register of Electrical Installation Contractors. The members were Messrs. H. J. Cash and E. Calvert, representing the Register, and Messrs. H. Marryat and L. C. Penwill for the E.C.A.

The 1936 E.C.A. Conference

At the above-mentioned meeting of the E.C.A. Council further consideration was given to the resolution passed at a previous meeting that no conference on similar lines to those previously held should be arranged for 1936, and this decision was confirmed. Consideration was also given to the further resolution passed at the meeting, deciding that a conference on different lines from those previously held should be arranged, to be held in London at the same time as the annual general meeting, no conference fees being charged. This decision was also confirmed.

Chilean Import Duties on Lamps

The Government authorities of Chile have recently increased the import duty on electric lamps for decoration or for heating, and for pressures of from 100 to 250 V, with Edison-type screw base, from 0.35 to 3.0 pesos per gross kg., and on those not specified in the preceding classification from 0.35 to 0.50 pesas per gross kg.

Architects' Conferences on Lighting

The Lighting Service Bureau has arranged a series of conferences on lighting for architects. They will be held in the recently reconstructed Bureau premises at 2, Savoy Hill, W.C. The subjects to be discussed include the following:—January 29th: "Effectiveness and Economics of Lighting Systems," by Mr. W. J. Jones. February 5th: "Recent Experiences in Lighting Practice," speakers, Messrs. J. R. Leathart, O. P. Bernard, P. J. Blundell Harland, and E. B. O'Rorke. February 12th: "Glass in Relation to Lighting in Architecture," by Mr. B. P. Dudding. February 19th: "The Application of Architectural Lighting to Existing Buildings," by Mr. R. O. Sutherland.

Social Events

A social and dance was held by the "Lewcos" Social and Athletic Club (London Electric Wire Co., & Smiths, Ltd.) on Saturday evening last at the New Baths Hall, Leyton. Mr. S. B. Klein (works manager), in a brief speech to a gathering of 550 people, regretted the absence of Mr. E. Leete (manag-

ing director), who had sent a message wishing the Club and its guests a happy new year. Mr. Klein congratulated the organising committee, of which Mr. A. H. Tyndall is secretary and Mr. C. W. Kelsey chairman, on its excellent efforts in making the evening a success. Music was provided by Mr. Lloyd Shakespeare and his B.B.C. Band. Miss Florence Oldham was also in attendance, supported by a clever cabaret in which apache dances and acrobatics on roller skates were enthusiastically received. Mr. J. O'Connor, the Essex cricketer, acted as M.C. The Mayor and Mayoress of Leyton, Mr. and Mrs. F. W. Turner, were also present, and the Mayor wished the company and its social activities success.

The Revo Electric Social and Sports Club held a New Year's Eve dance at the Tipton Baths, which was attended by 500 members of the staff. A photograph was taken during the evening, from which the accompanying illustration is reproduced.

The Recreation and Social Club of Messrs. J. H. Tucker and Co., Ltd., held its annual dinner, dance and concert on December 20th at the Imperial Hotel, Birmingham. A large gathering representative of every department assembled to do justice to the excellent Christmas fare. Appropriate short speeches by Mr. J. B. Tucker, managing director, and Mr. C. Macbeth, director, preceded the distribution of prizes to lucky menu holders, and this was followed by dancing.

Members of the Revo Electric Social and Sports Club at a New Year's Eve dance

A New Domestic Appliance Company

The plans and initial activities of Searsint, Ltd., have now been approved by the board of Sears, Roebuck & Co., the American mail-order concern, and an important group of British interests. Detailed arrangements were completed at the recent visit of Mr. E. J. Pollock, vice-president of Sears, Roebuck & Co., and the authorised capital of Searsint, Ltd., is to be increased to £100,000, divided equally between Sears, Roebuck & Co., and the British group. The products, to be marketed on an intensive scale in Great Britain and the Irish Free State, will, for the present, consist of electric refrigerators, vacuum cleaners, washing machines, radio sets, power driven tools, automatic stoking appliances, and agricultural implements. Other specialities will be added to the list from time to time, and in due course it is intended to manufacture in this country the products marketed.

The E.D.A. February Programme

The February programme of the British Electrical Development Association contains a number of poster stamps in attractive colours for use on letters and envelopes. The window display for the month has for its slogan, "A Lesson in Logic," and shows a cut-out schoolmaster figure behind a cooker pointing to blackboards on either side which explain how it pays to cook by electricity. Attention is also drawn in the programme to the Association's model house cut-outs, while members are reminded that it is not too late to order calendars for 1936.

Reduced Charges in Guildford

The Guildford Corporation Electricity Department has recently reduced its charge for electricity under the "all-in" system to 1d. for 3 kWh. This low tariff justified the prominent announcement which has been posted in the windows of the Electricity Department's showroom, and as our picture shows, it is attracting a good deal of attention.

Good news for the Guildford electricity consumers

Calendars and Diaries

The calendar of Crofts (Engineers), Ltd., has monthly sheets bearing illustrations of its products.

"An Old Dutch Village," by Noel H. Leaver, makes a charming picture for the calendar sent us by Messrs. Ernest F. Moy, Ltd.

The block calendar of Messrs. Flather & Co., Ltd., bears illustrations of some of the company's motors and dynamos.

"My Lady," who adorns the calendar of Messrs. Downes & Davies, makes an attractive picture.

The calendar of the Hart Accumulator Co., Ltd., has monthly sheets over which is an excellent picture of a yacht race from the original by Bernard Gribble.

Messrs. D. Gilson & Co., Ltd., have sent us a neat desk block calendar with a compartment for memo slips.

The calendar of Messrs. Blackstone & Co., Ltd., has monthly sheets on a card bearing an illustration of one of the company's Diesel engines.

Large monthly sheets form the calendar of Pope's Electric Lamp Co., Ltd.

As usual, a view of water-cooling towers appears on the calendar of the Davenport Engineering Co., Ltd., which has tear-off daily slips.

The calendar of Estler Brothers, Ltd., has monthly cards on each of which is a humorous drawing with an appropriate title relating to the company's products.

The Lytham St. Annes Corporation Electricity Department is again issuing two calendars this year. One has for its subject a cheeky puppy with a holder for a match box and the other is an excellent facsimile oil painting entitled "Golden Reflections," by A. de Breanski.

Trade Announcements

Mr. H. C. Bishop, who represents Hendersons Wholesale Electrical & Radio, Ltd., in the Hampshire and Dorset territory, has removed to 3, Avenue Road, Southampton (Telephone: 5976). The company's Hull agent has removed to School Street, Hull (telephone: Central 11671), where larger stocks will be carried.

Astralite Electrical Products has removed to 60/61, Red Lion Street, Clerkenwell, London, E.C.1 (telephone: Clerkenwell 5003).

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, January 8th: No change in the price of copper bars (best selected), sheet and rod. English pig lead, £17 10s., 5s. decrease. Spelter, £14 6s. 3d., 5s. decrease. English block tin, £212, £6 10s. decrease.

Messrs. Frederick Smith & Co. report, January 8th: No change in the price of electrolytic copper bars, wire rods and h.c. wire and silicium bronze wire.

Messrs. Edward Till & Co. report, January 8th: No change in the price of india rubber, Para fine.

For Sale

Bolton Electricity Department invites tenders for the purchase of two 4,000-kW turbo-alternators complete with condensing and auxiliary plant.

The West Central Merchandise Mart will sell by auction on January 16th at Torrens Street, E.C.1, the stock of a radio, electrical and cycle factor.

Sunderland Corporation has for sale motor-generators and a convertor.

The Yorkshire Electric Power Co. invites offers for the purchase of turbo-alternators and boilers.

(See our classified advertisements.)

New Catalogues and Lists

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.—A list of "Supreme" lighting fittings.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—A leaflet giving particulars of "Osira" laboratory lamps.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—Details of the new 840 radio receiver.

Watson & Sons (Electro-Medical), Ltd., 43-47, Parker Street, Kingsway, W.C.2.—A new price list of "Sunic" polished medical carbons.

Higgs Motors, Ltd., Birmingham.—Leaflets dealing with squirrel cage induction motors, direct current machines and controlling gear for induction motors.

Bankruptcy Proceedings

F. Cox, 16, Crown Street, Newark-on-Trent, Notts, lately 97, Balderton Gate, Newark-on-Trent, electrical engineer and wireless dealer.—The public examination was held on January 2nd at Nottingham. According to the statement of affairs lodged there were liabilities of £136 and a deficiency of £127. Debtor attributed his failure to insufficient electrical work, loss on sales of radio receivers through free service, and family illness. The examination was closed.

H. W. King, 124, Hither Green Lane, Lewisham, S.E., wireless goods dealer.—At the first meeting of creditors in London on January 1st, it was disclosed that the ranking liabilities amounted to £1,775, the net assets to £58, and the deficiency to £1,717. Debtor said his failure was due to heavy overhead charges, bad debts and keen competition. The case being a summary one was left in the hands of the Official Receiver.

G. F. Smith (G. H. Smith & Son), electrical engineer, 23, Blossomgate, and 6, Westgate, Ripon.—Trustee, Mr. C. H. Baker, 3, Alfred Street, Leeds, released December 13th.

L. E. Pearce (St. John's Electrical Co.), electrical engineer, 48, St. John's Road, Tunbridge Wells.—Second and final dividend of 7d. in the £, payable December 31st, at 6-7, Old Steine, Brighton.

C. Taylor, auto-electrical engineer, 6, William Street, Slough.—First meeting January 10th at 8, Forbury, Reading. Public examination January 24th at the Town Hall, Windsor.

A. D. M. Mayer, electrical engineer and wireless specialist, 75, Pasture Road, Goole.—Discharge suspended for three months until March 10th, 1936.

C. H. A. Sanders (Sanders Electric & Radio Service & Supplies), 231, Staines Road, Hounslow.—First meeting January 14th at 29, Russell Square, W.C. Public examination February 14th at the Court House, Half Acre, Brentford.

K. F. Butcher (Radiolectric Co.), 157, Hook Lane, Welling, Kent.—Application for discharge to be heard on January 22nd at Bankruptcy Buildings, Carey Street, W.C.

Company Liquidations

Searsint, Ltd.—Winding-up voluntarily. Liquidator, Mr. K. A. Layton-Bennett, 23, Blomfield Street, E.C. Particulars of claims to the liquidator by February 6th. This is a members' winding-up, and the claims of all creditors have been, or will be, paid in full.

Atlas Lamp Manufacturing Co., Ltd.—Meeting of creditors Feb. 5th at Ling House, South Street, Moorgate, E.C.2, to receive an account of the winding-up from the liquidator, Mr. Lewis Civval.

Johnson & Murrell Electric Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. C. Jones, 10, Clovelly Gardens, Tulse Hill, S.W.2. Particulars of claims to the liquidator by February 8th.

Broom & Wade, Ltd.—Particulars of claims by January 21st to the liquidator, Mr. A. E. Beauchamp, Buena Vista, Brands Hill Avenue, High Wycombe.

British Goldring Products, Ltd.—Meeting February 5th at 103, Cannon Street, E.C., to receive an account of the winding-up by the liquidator, Mr. R. J. Hayward.

Trojan (Manchester), Ltd.—Meetings February 3rd, at 13, St. Ann Street, Manchester, to receive an account of the winding-up by the liquidator, Mr. W. S. Berry.

Gill & Reigate, Ltd.—Winding up voluntarily. Liquidator, Mr. N. E. Munns.

New Showrooms at Wimbledon

A NEW Year's gift to Wimbledon electricity consumers in the form of a 25 per cent. discount for prompt payment of accounts was announced on January 1st by Alderman A. W. Hickmott, chairman of the Electricity Committee, at the opening of the Electricity Department's new showrooms at Station Bridge, Wimbledon.

Though the Corporation has had showroom and demonstration facilities successively at the generating station and in the basement of the Town Hall they have been more or less of a makeshift character and the well-equipped new premises will fill a long-felt need.

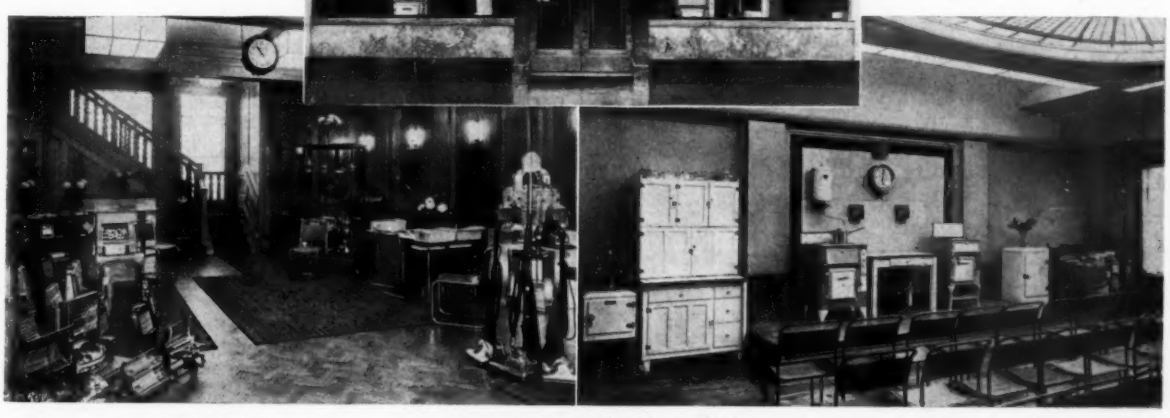
Alderman Hickmott stated, however, that while he appreciated the value of showrooms, progressive small reductions in electricity charges were the real attraction to consumers, experience having shown that the more reductions were made the greater were the profits. Although consumers were gradually availing themselves of the two-part tariff introduced eighteen months ago, the Corporation's electricity undertaking had been built up on the flat rate and he was not at all sure that this was not the better system. Statistics showed that the average annual consumption per house in the area now amounted to 1,100 kWh; practically no houses were without lighting, one in five consumers had an electric cooker and one in four an electric water-heater. The water-heater, installed with a change-over switch, was one of the best money-earning propositions his Department had undertaken. To deal with increasing business new electricity offices and workshops were to be opened in two months' time.

After paying tribute to Mr. A. E. McKenzie, the chief engineer and manager, and all others responsible for the prosperity of the undertaking, Alderman Hickmott said that the Electricity Department had a small balance in hand which it was proposed to give back to the consumers in the form of a bonus. Ordinary consumers would be given a discount of 25 per cent. for prompt payment of accounts, while an approximately equivalent concession would be made to fixed price light and maximum demand consumers by way of four half-weekly allowances; neighbouring authorities, too, would have their street lighting charges reduced by a quarter. The concessions represent a saving of about £23,000 to consumers.

In declaring the showrooms open the Mayor of Wimbledon, Alderman J. S. Holland Abbott, said that he hoped the residents would make good use of the new showrooms. Sir John R. Brooke, vice-chairman of the Electricity Commission, declared that Wimbledon might justifiably be called the spearhead of domestic electrification, and it came as a surprise to him, therefore, that it had till now possessed no electricity showrooms. Such extraordinary progress made by the Corporation's undertaking must be attributed therefore to the competence of the Electricity Department's staff and also to the policy of the Town Council in keeping on its Electricity Committee men whose abilities had been tried.

An electric kettle was presented to the Mayor by Alderman F. V. Milton, vice-chairman of the Electricity Committee, and an expression of appreciation of the work of his staff was made by Mr. McKenzie.

The new building comprises a general showroom on the ground floor, with a large demonstration room above. The latter is illuminated principally from laylights, with secondary lighting from wall brackets, the heating being provided by six thermostatically controlled convectors.



Three views of Wimbledon's electricity showrooms, showing (left) the ground floor, (centre) the exterior, and (right) the well-planned demonstration hall

Electricity Supply

Lighting, Domestic, Power

Acton.—ELECTRIC COOKING.—At Acton House, Horn Lane, comprising sixty new flats, thirty-four of the forty-one tenants have installed electric cookers and fires.—*Acton Gazette.*

Aberystwyth.—NEW MUNICIPAL UNDERTAKING.—At midnight on December 31st the Aberystwyth Corporation took over the Chiswick Electricity Supply Corporation's undertaking in the town, and simultaneously the lighting flat rate was reduced from 7d. to 5d. per kWh, the power rate being modified from 2½d. to 1½d. per kWh. A cheque for £44,715 was handed to the company's representative by Alderman T. H. Edwards, chairman of the Electricity Committee. The Mayor (Coun. Jenkin Humphreys) then received the keys from the engineer and manager (Mr. E. P. Perkins) and formally took possession. Among those present was Mr. L. L. Robinson, formerly electrical engineer of Hackney, and now a partner in the firm of Messrs. May & Hawes, who have acted as consultants to the Aberystwyth Corporation. The entire staff of the company has been re-engaged by the Corporation.

A group at the taking over of the Aberystwyth electricity undertaking on behalf of the municipality

Bexley.—EXTENSIONS.—In view of recent building development the Urban District Council is to extend its service mains in Hurst Road and Colyers Lane, Northumberland Heath.

Birkenhead.—NEW EQUIPMENT.—The Electricity Committee is to provide a sub-station and equipment in Grange Road at a cost of £3,522.

STREET LIGHTING.—Ford Road is to be lighted by electricity, according to a decision of the Watch Committee.

Blackpool.—CHANGE OF FREQUENCY.—The Electricity Committee has recommended that application shall be made for sanction to borrow £39,203 to meet the cost of changing the frequency from 83 to 50 cycles. The work will be spread over a period of three years.

Canada.—PROGRESS OF HYDRO-ELECTRIC SCHEME.—A report from our Toronto correspondent states that the third and fourth units of the Abitibi Canyon development of the Ontario Hydro-Electric Power Commission in Northern Ontario have been completed and are ready for operation. One unit is already in commission, and the other will be working within a few weeks. Each has a capacity of 66,000 h.p. A fifth unit should be completed at an early date. The total cost of these three units is approximately $2,000,000.

Cheadle (Staffs).—SUPPLY FOR WATER PUMPING.—The Rural District Council has arranged with the North-West Midlands Joint Electricity Authority for a supply of electricity to be provided to the new water-pumping station at Wallmyres.

Cheltenham.—STREET LIGHTING.—The Electricity Committee is to improve street lighting at a cost of £2,000.

SUB-STATION.—A site for a sub-station is to be obtained at Montpelier Retreat.

EXTENSIONS.—Cable extensions costing £1,567 are to be carried out for lighting the Whaddon Farm estate.

Colchester.—EXTENSIONS.—The Electricity Committee is seeking a Fringe Order to provide a supply to Goldhanger. Arrangements have also been made to furnish a supply, at cost of £663, to the Mount Bures pumping station of the Lexden Council. Consideration is being given to a scheme for supplying the Oakley Sands estate at an estimated cost of £1,150, and the Electricity Committee has arranged with the Frinton Park Estate Co., Ltd., for a modified scheme of mains extensions costing £436.

Coventry.—CHEAPER BULK SUPPLIES.—A revised scale of bulk supply charges has been prepared by the Electricity Department, as follows:—Up to 10,000 kWh per month, 0.60d. per kWh (present charge, 0.70d.); next 40,000 kWh at 0.42d. (0.48d.); next 450,000 kWh at 0.36d. (0.36d.); and all in excess of 500,000 kWh at 0.34d. (0.36d.).

Darlington.—MAINS.—The Corporation is to apply for a loan of £1,800 for laying high-voltage mains.

Doncaster.—MAINS AND SERVICES.—The Electricity Committee recommends that application shall be made for power to borrow £25,000, the estimated requirement for the next two years for new mains and services.

Eastbourne.—IMPROVED LIGHTING.—The Electricity Committee has agreed to make a contribution of £1,000 to the rates on condition that the money is devoted to decorative lighting on the front and Devonshire Place. Street lighting is also to be improved during the next two years at a cost of £5,355.

Erith (Kent).—TARIFF REDUCTIONS.—The Urban District Council has decided to reduce the lighting flat rate from 3½d. to 3d. per kWh. Substantial rebates are to be allowed to industrial consumers.

Fleetwood.—ELECTRIC CONVEYORS.—The London, Midland & Scottish Railway Co. has erected at Fleetwood the first of six electrically operated belt conveyors capable of dealing with 20-ton wagons. These conveyors will replace the present system of bunkering trawlers by means of cranes and buckets. The cost of this improvement is approximately £85,000.

France.—OUTPUT OF ELECTRICITY.—In its report for the financial year ended with June last, the Société de l'Electricité de Paris states that the sales of power by the undertaking and its affiliated concerns amounted to 548.5 million kWh, as compared with 547.3 million kWh in 1933-34. It is added that since 1930-31 there has been only a small annual increase in sales, this being attributed to the existing economic conditions and to the shrinkage in the demand for supplies for electric traction purposes resulting from the steady displacement of electric tramways in the Paris area by motor-buses. Actually, the amount of power taken for electric tramways is now less than one-fifth of what it was four years ago, but, fortunately, the loss has to a large extent been made up by the increase in the use of electricity for domestic purposes, while a contract has been secured for supplying part of the power required in connection with the Paris-Le Mans sections of the French State Railways as from about the end of 1936. The report also states that the Société Parisienne d'Interconnexions Électriques, which was jointly formed some time ago by the electricity undertakings in the Paris area, is busily engaged in carrying through its programme, which comprises the erection of a 220,000-V transmission line between Villevaudé and St. Denis, partly overhead and partly underground, and the establishment of a large sub-station comprising two 88,000-kVA, 220,000-60,000-V transformers near the St. Denis power station.

Gloucester.—CONTINUED ADVANCE.—In a report to a recent meeting of the Council, Ald. H. Harman, chairman of the Electricity Committee, stated that the development in the volume of the Committee's business was being maintained. He mentioned that the Christmas demands were about 20 per cent. greater than anything previously experienced.

EXTENSIONS.—The City Council recommends the following expenditure for extensions of supply: Wellsprings and Oxstalls, £2,050; Tuffley, £1,240; Brunswick Road area, £2,050; Sandhurst Lane, £530; and a milk depôt, £630.

Gravesend.—MAINS AND SERVICES.—Sanction to borrow £20,000 for mains and services is being sought by the Electricity Committee.

SUPPLY IMPROVEMENTS.—It is proposed to improve the supply in the Wrotham Road area at a cost of £1,120.

India.—ELECTRIFICATION OF THE UNITED PROVINCES.—The Legislative Council of the United Provinces of Agra and Oudh is considering an important electrification scheme estimated to cost two million rupees. It will benefit the eastern districts of the provinces, and will provide for water being pumped from the Gogra and Gompti rivers by means of steam turbine plant with the object of irrigating several thousand square miles of arable land at present barren. From the surplus power available neighbouring towns will be provided with electricity for lighting and minor industries.

Isle of Wight.—OVERHEAD CABLES.—The Rural District Council has consented to the Isle of Wight Electric Light & Power Co., Ltd., erecting overhead cables at Brighstone.

Keighley.—LOAN FOR WIRING.—Sanction has been obtained by the Electricity Committee to a loan of £10,000 for wiring installations.

Kettering.—NEW FEEDER CABLE.—Application is to be made by the Electricity Department for sanction to a loan of £29,645 for laying a new 11,000-V feeder cable from Kettering to Market Harborough, and the provision of the necessary switchgear, transformers, and alterations to buildings.

Leeds.—A LARGE LOAN.—The Electricity Committee is seeking sanction to borrow £120,000 for electricity services.

Liverpool.—LOAN FOR PLANT.—The Electric Power and Lighting Committee is applying for sanction to borrow £5,775 for transformers and switchgear required at the Lister Drive power station.

London.—STEPNEY.—The improved illumination of Cable Street, Stepney, which is effectively shown by the accompanying photographs, is entirely due to the employment of up-to-date

lanterns correctly designed and constructed to control the light output, since in both cases the total loading of each standard is 500 W. The lanterns, of which there are forty-two, were supplied by the Edison Swan Electric Co., Ltd., and are known as the Ediswan "Stepney" type. Each employs one 500-W incandescent gasfilled lamp and replaces a fitting which consisted of a cluster of five 100-W lamps. Constructed of copper with cast aluminium top housings, the lanterns have special anti-condensation connector boxes, and the reflector system embodied ensures maximum road brightness with minimum glare and absence of shadow. The reflector system is so designed as to be suitable for 300/1,000-W gasfilled lamps, or 200/400-W "Escura" electric-discharge lamps. The installation was carried out by the Electricity Department under the direction of Mr. A. E. Campbell, the borough electrical engineer and manager.

The importance of correct reflectors is shown by these two illustrations of the old and new lighting in Cable Street, Stepney. In both cases the total loading for each standard is 500 W

Maidstone.—NEW MAINS.—Mains are to be extended at a cost of £775 to supply 107 houses to be built on the Roseacre estate, Bearsted. Mains are also to be relaid in five thoroughfares, at an estimated cost of £1,310.

New Zealand.—PROPOSED EXTENSION OF HYDRO-ELECTRIC PLANT.—According to the Australian *Electrical Engineer and Merchandiser*, the Public Works Department is planning to extend its power development at Lake Waikaremoana, first by installing another 16,000-kW unit at the existing power station, and secondly by building further stations of 48,000 kW and 32,000 kW above and below the present station.

Northern Ireland.—LARGE INCREASE IN BELFAST CONSUMPTION.—In 1934-35 the Belfast Electricity Department sold 28.6 million kWh (32.7 per cent.) more than in the preceding year, 10.1 million kWh of this amount representing additional supplies to the Electricity Board. During the period from April 1st to December 3rd there has been a further increase of 16.5 million kWh (24 per cent.) over the corresponding period of 1934, and it is estimated that the total sales for 1935-36 will amount to 140 million kWh. During the last financial year the load within the area of supply rose by 15,754 kW to 129,286 kW, and since April 1st a further 10,000 kW has been added. A new 30,000-kW turbo-alternator is nearing completion, and it is anticipated that the set will be the means of effecting further economies in working costs.

Norton.—RURAL SUPPLIES.—In a report on an interview with representatives of the Electricity Commissioners the clerk to the Rural District Council states that he drew attention to the delay in supplies being provided to villages in the Council's area and to the numerous requests for such facilities. The representatives of the Commissioners informed him they were satisfied that a case had been made out warranting careful consideration.

Oswestry.—EXTENSIONS TO UNDERTAKING.—The Town Council has decided to spend £11,500 on extensions to the electricity undertaking.

Ploughley (Oxon).—OVERHEAD LINES.—The Rural District Council has consented to the Wessex Electricity Co. erecting overhead lines from Chesterton to Middleton Stoney. The Council has drawn the attention of the company to the urgent need of a supply in the parishes of Noake, Oddington, Charlton-on-Otmoor, Fencot, Murcot, Merton, and Somerton.

Retford.—EXTENSION TO STURTON.—Coun. A. Peatfield, chairman of the Electricity Committee, recently performed the switching-on ceremony at Sturton-le-Steeple, following the extension of the Corporation's mains to the village. The old parish church was floodlighted for the occasion and attracted considerable interest.

Rotherham.—SUB-STATION.—It is proposed to provide a substation and equipment at a cost of £2,568 to meet the increasing demands for electricity for traction at Maltby.

Rugby.—BULK SUPPLY.—The prolonged dispute between the Town Council and the Leicestershire and Warwickshire Power Co. in regard to the bulk supply charges has been settled. A five-year agreement is to be entered into by which it is estimated the Corporation will save £20,000 over the period, providing the load increases at the same rate as during the last two years.

Salford.—NEW TRANSFORMER.—An additional transformer is to be installed in the Blackfriars sub-station at a cost of £5,660.

Sheffield.—MAINS EXTENSIONS.—The Electricity Committee has approved extensions to mains at a cost of £20,759.

Sleaford.—CHANGE-OVER.—Plans are to be prepared by the Electricity Committee for changing over the supply in the centre of the town.

Southend-on-Sea.—SUPPLY TO ADDED AREA.—The Town Council has reached an agreement with the County of London Electric Supply Co., Ltd., with reference to the supply of electricity in the area added to the borough by the Southend Extension Order, 1933, the amount payable to the company being £15,221.

South Wales.—PROGRESS DURING 1935.—Mr. A. Nichols Moore, electrical and tramways engineer of Newport (Mon.), in an article contributed to the annual trade supplement issued by the *Western Mail and South Wales News*, states that the Newport undertaking now has a capacity of 30,000 kW. For the twelve months ended December 31st last, the estimated total output was 90,000,000 kWh, equivalent to an increase of 40 per cent. over that for 1934, while the total number of consumers connected to the supply mains of the undertaking was 23,000, as compared with 21,000. During 1935 the number of electric cookers operating in the town reached a total of about 7,000, equivalent to nearly one in three of all householders. Referring to extension schemes, Mr. Nichols Moore states that two additional boilers with a combined evaporative capacity of 160,000 lb. of steam per hour are ex-

This recent street lighting installation at Framwellgate Moor, Co. Durham, involves the use of "Mazda Mercra" lamps in B.T.H. "Diron" lanterns

pected to be available for service shortly, and that it will then be possible to utilise the generating plant to the fullest extent. The Cardiff Corporation electricity undertaking also made considerable progress during 1935, according to Mr. Edward Jones, the city electrical engineer. He reports that the amount of electricity sold increased by 23 per cent. over the previous year; the total number of consumers passed the 50,000 mark; and at the end of the year 4,540 electric cookers were connected. A considerable amount of work is being carried out in changing over the mains in the centre of the city. Mr. J. W. Burr, electrical engineer of Swansea, discloses that 1935 saw the connection of approximately 2,500 new consumers to the mains, with an increase of over 100 per cent. in sales under the rateable value tariff and a total increase in sales of roughly 5,000,000 kWh, or nearly 8 per cent. on the previous year. In addition, there was the opening of the Tir John station.

Stone (Staffs).—BULK SUPPLY CHANGE.—The Stoke-on-Trent City Council has reduced the charge for the bulk supply to the Stone urban electricity works to £3 10s. per kW of maximum demand.

Taunton.—REVISED TARIFF.—The Town Council has amended its charges for supplies to shops, offices, schools, places of entertainment, hotels, etc., where electricity is used for lighting and heating (or power) and where the lighting consumption is not more than ninety per cent. of the total quarterly consumption. Up to 500 kWh per quarter there is to be a reduction of 2½ per cent. from the ordinary scale charges; from 501 to 1,000 kWh, five per cent. reduction; 1,001 to 5,000 kWh, ten per cent.; and beyond, a reduction of 12½ per cent.

Torquay.—STREET LIGHTING.—Improvements in street lighting are to be carried out at a cost of £5,080.

Walton and Weybridge.—NEW EQUIPMENT.—A loan of £3,745 for cables, switchgear, and a kiosk for the supply to the Towers estate, Oatlands Drive, has been applied for by the Council.

Whitehaven.—A SUPPLY EXTENSION.—Application has been made by the Town Council for an Order to undertake the supply of electricity to the Woodhouse estate.

Withernsea.—LIGHTHOUSE CONVERSION.—The Withernsea lighthouse is to be converted from oil to electric lighting within the next ten weeks. There will be two lamps, one to run from mains supply and the other from an emergency battery. An alarm bell will come into action if anything goes wrong, and at the same time the light will be automatically switched over to the battery lamp.

Worthing.—RURAL ELECTRIFICATION.—The Rural District Council has in hand a scheme for providing electricity to the villages of Burpham, Lyminster, Poling and Warningcamp.

Wrexham.—AMENDED TARIFF.—The Council has approved revisions in the charges for electricity for domestic purposes. As an alternative to the flat-rate lighting and heating charges, it is proposed to introduce a new tariff for lighting, heating and other domestic uses, based on 15 per cent. of the rateable value of the house, up to and including £30, and 10 per cent. of any excess, plus ¾d. per kWh up to 50 kWh in any one quarter, and ½d. per kWh for all in excess of that amount. There will be a discount of 5 per cent. for prompt payment.

Traction

Dundee.—TROLLEY-BUSES.—A proposal that trolley-bus services should be inaugurated to serve estates in the north of the burgh was made at a recent meeting of the Transport Committee. Plans may be drawn up later by the transport manager for the running of trolley-bus services on certain routes.

Egypt.—CAIRO SUBURBAN LINES.—A re-examination of the proposals for the conversion of certain railways round Cairo has resulted in the recommendation that the most urgent case for electrification is the Mataria line, but that this should not be undertaken without the construction of a cross-city electric underground railway connecting the Mataria terminus with the terminus of the Helwan line at Bab El-Louk. It is felt that the conversion of the Helwan line, for which there has been a public demand, would not be justified unless the Mataria line and city subway projects were dealt with first.

Italy.—NEW MILAN TRAMS.—The Milan Tramways have acquired a number of new trams of an articulated design which has been on trial since 1933. Two four-wheeled vehicles with wide entrance doors at each end are joined by a bellow connection to a central steel vestibule having large exit doors. The overall length is 62 ft. and the tare weight 19 tons.

Manchester.—TROLLEY-BUSES.—The new Parliamentary Bill for the adoption of trolley-buses was supported by a recent meeting of ratepayers, but it is being opposed by the Salford and Stretford Councils until the Manchester Corporation agrees to certain provisions to protect their interests.

ELECTRIC RAILWAY PROPOSALS.—The question of providing an underground railway in Manchester was discussed at the City Council meeting on Wednesday. The proposal is to reconstitute the old Underground Railway Special Committee. The suggested electrification of railways in the South-east Lancashire district is to come up for discussion in London shortly, while the railway companies are also to meet the Manchester and District Town Planning Advisory Committee to discuss electrification.

Norway.—RAILWAY ELECTRIFICATION.—As soon as the Norwegian Storting re-assembles the Government intends to lay before it a scheme for the electrification of the Ostfold railway as far as the Swedish frontier station of Kornsjö. The expenditure is estimated at Kr. 11 to 12 million.

Sweden.—IMPORTANT ELECTRIFICATION SCHEME.—*Reuter's Trade Service* learns from Stockholm that Bergslagernas Järnvägsaktiebolag, one of the biggest private railway companies in Sweden, is inviting tenders for the electrification of the line between Göteborg and Aamaal, a distance of 164 km. At the same time the company invites tenders for the necessary electric locomotives. When the railway company asked the Government for a concession two years ago it was estimated that the cost of the electrification of the section would be Kr. 10,100,000, of which Kr. 3,000,000 would be for the circuits and Kr. 4,840,000 for the locomotives and motor coaches. No concession has yet been granted for the work. It is thought that the question of the electrification of the 65-km. line from Mellerud, on the Bergslagernas line, to Kornsjö, on the Norwegian frontier, owned by Dalslands Järnväg, will be coupled with the Bergslagernas scheme, and that the Government will give permission for the electrification of both lines.

Switzerland.—PROPOSED ELECTRIFICATION.—It is reported in the *Railway Gazette* that the electrification of the South-Eastern Railway is projected. This small, standard-gauge system comprises a main line from Arth-Goldau, on the St. Gothard route, to Pfäffikon and across Lake Zürich on a causeway to Rapperswil, with branches from Biberbrücke to Einsiedeln and from Samstagern to Wädenswil. At present the rolling stock is antiquated, and for quite moderate traffic it is necessary to use two or three steam locomotives to negotiate the long continuous gradients of 1 in 20. It is expected that the system could be worked expeditiously with three electric locomotives and five electric railcars, and that a speed of 40 km.p.h. could be attained on the steepest gradients with a 150-ton train behind each locomotive and 50-ton railcars.

Communications

Great Britain.—ANOTHER TELEPHONE RECORD.—The eleven thousand trunk calls made between 5 p.m. and midnight on New Year's Eve established another record in the use of shilling trunk calls, exceeding the previous record, established on Christmas Eve, by a thousand calls.

POLICE TELEPHONE SYSTEM.—Last Monday a new police telephone system was introduced throughout the Metropolitan Police "J" Division. Fifty kiosks have been built and so arranged that ordinarily no person need travel more than half a mile before reaching either a police station or a police telephone kiosk. So far, 379 kiosks have been installed in eight Metropolitan Police divisions.

BROADCASTING IN 1935.—The aggregate transmission time of all transmitters (excluding the Empire station) during 1935 was 68,796 hours (63,109 hours in 1934), the average breakdown percentage being 0.026 (0.022). The Empire station transmitted for 11,662 (10,897) hours. Work has been proceeding on a new station at Lisburn, Northern Ireland, which will be opened on March 20th by the Duke of Abercorn and will replace the existing low-power transmitter at Belfast. The North Scottish Regional station will be ready by the middle of next year, and work is proceeding on the north-east of England Regional station at Bewclay, which will replace the low-power transmitter at Newcastle. A site has also been purchased at Beaumaris, on the Isle of Anglesey, for a relay station to serve North Wales. Work has been put in hand on extensions to the Empire station at Daventry; orders have been placed for two high-power short-wave transmitters, and land has been purchased for additional aerials. The existing aerials will be modified in the light of recent experiments. New studio headquarters are being constructed in Glasgow, and in London four up-to-date new studios have been brought into use in the Maida Vale premises. A new studio centre has been equipped at Bangor, while renovating and re-fitting of studio premises has continued at Edinburgh, Belfast, Cardiff and Birmingham. The sound-recording rooms at Maida Vale have been equipped with extensive and modern apparatus. In addition, a mobile recording unit has been put into service, and others are under construction. A portion of the Alexandra Palace is being adapted for use as a television transmitting station. Orders for two high-definition television transmitters have been placed with Baird Television, Ltd., and the Marconi-E.M.I. Television Co., Ltd. A third transmitter for the sound channel has also been ordered. Thirty-line transmissions ceased on September 11th after just over three years' operation, during which time 480 programmes were transmitted and 4,151 artists were presented.

CHEAPER TELEPHONE RATES.—It is hoped, next spring, to reduce the charge for a three-minute call between Belfast and London from 5s. to 3s. 6d.

Italy.—EXPERIMENTS WITH MICRO-WAVES.—Reports in the Italian Press indicate that the Marchese Marconi is to renew his experiments with micro-waves early in February. They will take place at Santa Margherita Ligure.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Army Contracts.—Manufacturers who are not on the War Office list of tenderers and wish to be invited to tender for general stores should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, S.W.1. (January 3rd.)

Australia.—MELBOURNE.—February 17th. State Electricity Commission of Victoria. Three oil-insulated outdoor type automatic induction voltage regulators with accessories. (T.Y. 10277.)*

February 24th. City Council. 22,000-V and 6,600-V switchgear. (T.Y. 10314.)*

Blackpool.—February 11th. Corporation. Contracts 1 and 2: Screening plant, with electric motors, starting gear, electrically driven wash water pumps and accessories. Contracts 3 and 4: Large capacity vertical spindle axial flow pumps with electric motors, starting gear and accessories. Borough engineer, Municipal Buildings (deposit £1 1s. in each case).

Bradford.—January 20th. Corporation. Electric lighting at new nurses' home, St. Luke's Hospital. Office of the City Architect, Town Hall.

Cardiff.—January 21st. Electricity Department. R.D.C. Supply, laying and jointing of underground feeder and distributor cables. (See this issue.)

Carlisle.—January 24th. Electricity Department. Equipment for lighting a thoroughfare by electric discharge lamps. (See this issue.)

Dartford.—January 11th. Cable and joint boxes. (December 27th.)

East Retford.—January 22nd. Electricity Department. Switchgear, rectifiers and transformers. (See this issue.)

Egypt.—CAIRO.—January 28th. Ministry of Public Works. Electric washing machines and hydro-extractor. (T.Y. 5600.)*

Edinburgh.—January 16th. Corporation. Various works, including electric lighting and heating, at Craigmillar Intermediate school. City architect.

Gainsborough.—February 7th. Electricity Department. Materials for twelve months. (See this issue.)

Glasgow.—January 16th. Corporation. Electrical installations at Landressy Street estate. Town clerk (Room 36).

Guildford.—January 20th. Guildford and Godalming Joint Hospital Board. Wireless receiving apparatus for the Woodbridge Isolation Hospital. E. W. Sellings, clerk to the Board, Millmead House.

Hastings.—January 30th. Electricity Department. Materials. (See this issue.)

Hazel Grove and Bramhall.—January 24th. Electricity Department. Sub-station switchgear equipment. (See this issue.)

Heston and Isleworth.—January 23rd. Electricity Department. One 5,000-kVA and two 600-kVA transformers with on-load tap-changing gear, 11,000-V truck-type cubicle and l.p. switchgear. (See this issue.)

Huddersfield.—January 24th. Corporation. Automatic electric lift in the Estate Buildings. (See this issue.)

Hull.—Telephone Committee. Public automatic telephone exchange. (January 3rd.)

January 21st. Electricity Department. Meters; stores for one year. (See this issue.)

Ilford.—January 24th. Electricity Department. E.h.p. switchboard and oil switches. (January 3rd.)

Irish Free State.—DUBLIN.—January 31st. Electricity Supply Board. Twelve months' supply of power transformers. (December 20th.)

Kettering.—January 29th. Electricity Department. 11,000-V switchboard, cable and joint boxes. (January 3rd.)

Liverpool.—January 20th. Electric Supply Department. Materials for twelve months. (January 3rd.)

London.—METROPOLITAN WATER BOARD.—February 25th. Eight steam turbines with centrifugal pumps, electric generators, &c., at the pumping station, Hampton. Chief engineer, Room 235, 173, Rosebery Avenue, E.C.1 (deposit £5 5s. to be deposited with the accountant of the Board).

HAMMERSMITH.—January 22nd. Borough Council. Stores and materials for twelve months. (January 3rd.)

ISLINGTON.—January 15th. Electricity Department. Lanterns for street lighting, electric discharge lamps, and lanterns fitted for gasfilled high-wattage lamps. (See this issue.)

Manchester.—January 21st. Electricity Committee. Electric cookers. (December 27th.)

January 31st. Remote-electrically-controlled 33-kV switchgear with circuit-breakers. (See this issue.)

January 16th. Education Committee. Electrical installations in cottages at Styal Cottage Homes, and alterations and additions to the electrical installations at City Road Municipal school, Hulme. Surveyor's Department, Education Offices, Deansgate.

Middlesbrough.—January 27th. Electricity Department. 11,000-V cable. (See this issue.)

Morecambe and Heysham.—February 5th. Electricity Department. Static transformers. (See this issue.)

Musselburgh.—January 20th. Town Council. Electrical work at new public washhouses at South Street. J. Logan, Burgh surveyor, Town Hall.

New Zealand.—WELLINGTON.—February 4th. Public Works Department. Switchgear for the Mareretu Tahekeroa and Maungatapere stations. (T.Y. 10274.)*

March 3rd. Machine tools and electrical and pneumatic equipment for the Wigram aerodrome workshops. (T.Y. 5612.)*

April 21st. 50-kW, 3-phase, 415-V, 50-cycle, Diesel-engine-driven generating set. (T.Y. 10302.)*

March 11th. Post and Telegraph Department. 100 miles of insulated bronze wire. (T.Y. 10293.)*

February 18th. 50,000 1.5-V telephone cells. (T.Y. 10304.)*

March 9th. 1,500 metal-cased condensers. (T.Y. 10310.)*

March 11th. 2,500 fuses and fuse wire. (T.Y. 10303.)*

DUNEDIN.—March 27th. City Corporation. Two three-phase transformers and 6,600-V and 35,000-V switchgear. (T.Y. 10309.)*

Northern Ireland.—BELFAST.—January 16th. Electricity Department. Materials for twelve months. (December 27th.)

January 18th. Water strainers and electrically operated driving gear for penstocks. (January 3rd.) Electrical installations in residences (assisted wiring scheme) during the period from April 1st, 1936, to March 31st, 1937. City electrical engineer and manager, East Bridge Street (deposit £1 1s.).

Plymouth.—January 21st. Electricity Department. Two 16-kW motor-generators with control gear. (See this issue.)

Prestonpans.—January 21st. Town Council. Electric lighting at forty-six houses. R. and A. K. Smith, surveyors, 4, Forres Street, Edinburgh.

Salford.—January 15th. Corporation. One 12,500-kVA transformer. (December 27th.)

Sheffield.—February 10th. Electricity Committee. Two 30,000-kW turbo-alternators with condensers and auxiliaries. (See this issue.)

Shipley.—January 31st. Electricity Department. L.p. cables. (See this issue.)

Southend-on-Sea.—February 3rd. Electricity Department. Stores for one year. (See this issue.)

South Africa.—GEORGE.—February 19th. Municipality. Plant for the reconstruction of the electricity undertaking, consisting of boilers and steam-raising plant, turbo-alternators, one 400-kW alternator and switchgear. E. Val Davies, consulting engineer, Johannesburg.

JOHANNESBURG. January 27th. Railways and Harbours Administration. Two 25-ton capacity overhead electric travelling cranes. (T.Y. 5579.)*

February 3rd. 10-ton capacity overhead electric travelling crane. (T.Y. 5582.)*

Swansea.—January 24th. Electricity Department. Materials for twelve months. (January 3rd.)

Torquay.—February 3rd. Corporation. Supply of electric lamps, &c., during the period beginning April 1st next. Borough engineer.

Witham.—January 13th. U.D.C. Two stereophagus pumps and electric motors for the sewage disposal works. Surveyor, Council Offices, Collingwood Road.

* Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Australia.—COMMONWEALTH.—P.M.G.'s Department. Accepted. Underground cable.—Metal Manufacturers Pty., Ltd.; British Insulated Cables, Ltd. Induction coils and registers (£8,500).—British General Electric Co., Ltd. Relay sets (£262).—Ericsson Telephone Mfg. Co. Electric lamps.—British General Electric Co., Ltd.; Siemens (Aust.) Pty., Ltd.

VICTORIA.—State Electricity Commission. Accepted. Triple-braided copper aerial cable.—Enfield Cable Works (A'asia), Ltd.; Liverpool Electric Cable Co.—*Tenders.*

Birkenhead.—Electricity Committee. Accepted. Wiring installations in 106 houses (£346).—David Rowan, Ltd. Switchgear at Eastham (£219) and at Stuart Road (£135), and one feeder equipment (£170).—A. Reyrolle & Co., Ltd. Three ring-main isolators (£150 each).—Metropolitan-Vickers Electrical Co.

Colchester.—Electricity Committee. Recommended. Extension of contracts for electric cookers for a further twelve months.—Jackson Electric Stove Co.; Carron Company.

Ealing.—Electricity Committee. Accepted. Quarterly meters (house service type).—Ferranti, Ltd. Prepayment meters (house service type).—Venner Time Switches, Ltd.

Kettering.—Electricity Committee. Recommended. Two 1,000-kVA transformers (£436 each).—British Electric Transformer Co., Ltd. One seven-panel, e.h.p. switchboard (£1,071).—Harland Engineering Co., Ltd. Feeder cables (£563 per 1,000 yds.).—Union Cable Co., Ltd.

London.—DEPTFORD.—Housing Committee. Electrical installation at Brockley estate:—

	£
Pruden & Pope (Accepted)	**541**
Kirkdale Electrical Co.	574
J. H. Plant, Ltd.	578
General Electrical Maintenance Co.	659
Read & Partners, Ltd.	784
South Metropolitan Electric Light & Power Co., Ltd.	818
Keating & Miskin, Ltd.	1,123

Manchester.—Electricity Committee. Recommended. Supplies for twelve months: Single-phase fan motors.—General

Electric Co., Ltd. 400-V sub-station switchgear.—Parmiter, Hope & Sugden, Ltd.; Bertram Thomas. Sub-contractors: Record Electrical Co., Ltd., for ammeters and current transformers; Everett, Edgecumbe & Co., Ltd., for ammeters; Harland Engineering Co., Ltd., for current transformers.

Watch Committee. Accepted. Electric passenger lift at chief fire station.—Etchells, Congdon & Muir, Ltd.

Northampton.—Baths Committee. Recommended. Electrical installation at new baths (£1,565).—Grensells, Kettering.

Rotherham.—Transport Committee. Recommended. Rectifier equipment (£775).—Hewittic Electric Co., Ltd. Switchgear (£222).—Whipp & Bourne, Ltd.

Sunderland.—Town Council. Accepted. Two 1,500-kW steel tank rectifiers (£11,130).—General Electric Co., Ltd. E.h.p. switchgear control and replacement for switchgear at the Dunning Street sub-station (£2,571).—A. Reyrolle & Co., Ltd.

Sutton Coldfield.—Electricity Committee. Recommended. Cable extensions (£978) and transformers and switchgear (£175). —Callender's Cable & Construction Co., Ltd.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, January 16th. Institution, London. 6 p.m. "Recent Developments in Long-Distance Telephony." Mr. A. C. Timmis.

North-Eastern Centre.—Monday, January 13th. Armstrong College, Newcastle-upon-Tyne. 7 p.m. "A Cathode-Ray Oscillograph with High Speed Drum Camera Rotating *in vacuo*." Mr. G. A. Whipple.

South Midland Centre.—Monday, January 13th. James Watt Memorial Institute, Birmingham. 7 p.m. "Modern Developments in Railway Signalling." Major L. H. Peter.

Western Centre.—Monday, January 13th. Royal Hotel, Cardiff. 6.30 for 7 p.m. Annual dinner and dance.

East-Midland Sub-Centre.—Tuesday, January 14th. Electricity Showrooms, Derby. "Frequency Change Problems." Mr. R. H. Rawll.

North-Western Centre.—Tuesday, January 14th. Engineers' Club, Manchester. 7.15 p.m. "Applications of the Hot-Cathode Grid-Controlled Rectifier or Thyratron." Mr. A. L. Whiteley.

Scottish Centre.—Tuesday, January 14th. 39, Elmbank Crescent, Glasgow. 7.30 p.m. "Private Plants and Public Supply Tariffs." Mr. J. A. Sumner.

Wireless Section.—Tuesday, January 14th. Institution, London. 6.30 p.m. Informal meeting. Discussion on "Ultra Short Waves for Broadcasting." To be opened by Sir N. Ashbridge.

Irish Centre.—Wednesday, January 15th. Physical Laboratory, Dublin. 6 p.m. Particulars to be announced later.

Sheffield Sub-Centre.—Wednesday, January 15th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "The Cathode-Ray Oscillograph." Mr. I. B. Davidson.

Transmission Section.—Wednesday, January 15th. Institution, London. 6 p.m. "The Measurement of Discharges in Dielectrics." Messrs. A. N. Arman and A. T. Starr. "Routine Over-Voltage Testing of E.H.T. Cables." Mr. C. Kibblewhite.

British Electrical Development Association (*Northern Counties Area*).—Friday, January 10th. Oxford Galleries, Newcastle-upon-Tyne. Carnival ball.

Junior Institution of Engineers.—Friday, January 10th. Institution, London. 7.30 p.m. "Refractory Materials." Dr. J. H. Partridge.

Electrical Power Engineers' Association (*London Technical Group*).—Monday, January 13th. Caxton Hall, London, S.W.1. 7.15 p.m. "Large Transformers." Mr. E. Tobin.

Association of Mining Electrical Engineers.—Tuesday, January 14th. Junior Institution of Engineers, London, S.W.1. 6.30 p.m. "Some Considerations in the Design and Manufacture of Miners' Electric Safety Lamps." Mr. E. Lyon.

South Wales Branch.—Saturday, January 11th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Some Comparisons in Mine Shaft Signalling." Mr. G. A. Cowles.

Illuminating Engineering Society.—Tuesday, January 14th. Institution of Mechanical Engineers, London, S.W.1. 7 p.m. Discussion on "Applications of Ultra Violet Light and Some Aspects of Fluorescence and Phosphorescence." To be opened by Mr. F. E. Lamplough.

Notes

An Up-to-date Inn

Several interesting features are to be found in the electrical installation which Messrs. S. Rogers & Co., Ltd., have just completed at the Daylight Inn, Petts Wood. In the charmingly decorated dance hall, as well as other parts of the public portion of the inn, is demonstrated the eminent suitability of thermostatically controlled tubular heaters (Unity) concealed by grilles in the skirting for warming this class of building, control being effected from two centrally placed switchboards with neon indication lamps. The dance hall also possesses up-to-date stage-lighting equipment (G.E.C.) comprising four-colour battens and footlights with Strand Electric spotlights. For the general illumination of the room reflectors concealed behind the tops of the wall pillars provide a pleasant golden light which is supplemented by lacquered brass and glass wall brackets fitted with pink candle lamps.

Novel octagonal lacquered brass pendant fittings having a central lamp concealed behind pale green opaque glass with candle lamps at each of the projections are used in the entrance hall, while in the lounge, which is of the "old-fashioned country-house" style, the illumination comes from two plain octagonal pendants together with several lantern brackets of attractive design round the walls and one each side of the bar.

Altogether there are in the building about two hundred lighting points for which the fittings have been specially designed by Messrs. Smith & Ansell, Ltd., and practically all of them in the public portion are controlled from a single switchboard situated in the office.

The whole of the cable used in the building has been supplied by the Union Cable Co., Ltd., screwed barrel being employed throughout. A three-phase a.c. supply from the West Kent Electric Co., Ltd., taken *via* a cable-dividing box (W. Lucy & Co., Ltd.) to "Glasgow Rex" and "Memrex" ironclad switch and fusegear for distribution through the building.

Other items of electrical interest include eight "Sieray" floodlights mounted on poles to illuminate the exterior of the building, a neon sign of the name of the inn supplied by Pearce Signs, a Marryat & Scott service lift and a G.E.C. telephone installation. The building has a total load of 120 kW. Pictures of the inn appear on page 55.

Paper Mill Drives

The paragraph on page 898 of our December 27th issue stating that an a.c. sectional drive has been installed in the large new extension to the Kemsley Mill of Messrs. Edward Lloyd, Ltd., while correct in itself, should not be coupled with the subsequent reference to a sectional drive operating "on the synchronous tie-in system." The latter, which is new to this country, relates to another installation carried out by the B.T.H. Co.

Electrical Engineers' Ball

The electrical engineers' ball will be held at the Grand Hotel, Harrogate, on January 24th. Tickets, inclusive of dinner, one guinea each (15s. to student members and graduates of the I.E.E.), can be obtained from Mr. W. R. T. Skinner, hon. secretary, 36, Park Place, Leeds.

The Batti-Wallahs' Society

This Society's next luncheon is to be held at the Hotel Metropole, London, W.C.2, on Thursday, January 23rd. The speaker will be Sir Clement Hindley, K.C.I.E., who has chosen as his subject "Horse Racing and the Tote."

The Case for the Standard Plug

Mr. P. Good, deputy-director of the British Standards Institution, informs us that in the recently published statement on the above subject (ELECTRICAL REVIEW, December 20th, p. 856) it was stated that the decision to press for complete interchangeability of plugs and sockets had been *unanimously* endorsed by the Council of the Institution of Electrical Engineers. He regrets that, through an oversight, this expression was used in his communication to us. In the first place, he says, it was obviously improper to refer without permission to proceedings of the Council of the I.E.E., and he is further informed that the use of the word "unanimously" was incorrect.

Appointments Vacant

Distribution assistant and lady showroom assistant for Newton-in-Makerfield Electricity Department.

Technical assistant to the consumers' engineer for Southampton Electricity Department.

Junior scientific officer, assistant II and assistant III, in the Admiralty Scientific and Technical Pool.

Male assistant superintendent of traffic (Class II) in the London Telephone Service, and male assistant traffic superintendent in the Provinces. G.P.O.

Lady showroom attendant for Rhondda Electricity Department.

Lady showroom assistant for Pudsey Electricity Department.

Principal showroom assistant for Woolwich Electricity Department.

Teacher in electrical engineering, mathematics and other subjects at the Technical & Art Institute, Watford.

Chief assistant for Darwen Electricity Department.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

SCADCU copper alloy.
MARTIN flash-lamp batteries.
VICTORIA flash-lamp batteries.
COSIE heating pad.
Spring galleries (2¼-in. diameter) for inside or outside grip.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. W. Finlay, of the Electrical Contractors' Association of Scotland, has been elected chairman of the Electrical Fair Trading Council, for the time being, in the place of the late Mr. D. N. Dunlop.

Mr. A. L. McColl, deputy chairman and joint managing director of the Vacuum Oil Co., Ltd. since 1933, has been appointed chairman of the board of directors on the retirement of Mr. W. Cross. **Mr. H. Holliday,** formerly joint managing director, is now managing director. Mr. McColl, who is a native of Kilmarnock, joined the company in 1905 in a junior capacity, and fourteen years later was elected a director. He is well-known in industrial, marine and railway circles, and he is a director of the Superheater Co., Ltd., and the Indestructible Paint Co., Ltd.

[*Elliott & Fry*

Mr. A. L. McColl

Mr. P. M. Colvin Smith has been presented by the staff of the Scottish Southern Electric Supply Co. with a silver salver and a cigarette box on the occasion of his leaving to take up an appointment as an assistant consumers' engineer with the Portsmouth Electricity Department.

Mr. H. Butterworth, of Failsworth, Manchester, a member of the technical staff of the Central Electricity Board, was married on January 4th to Miss C. A. Macauley.

Mr. J. Fairburn, superintendent of the Valley Road power station of the Bradford Corporation Electricity Department, retired on January 1st after thirty-one years' service. He has been responsible for the supervision of substantial extensions at the station during his period there, the plant having increased from 7,380 to 102,000 kW, and the number of consumers from 1,884 to 46,380.

Mr. L. E. Aulagnier, A.M.I.E.E, F.C.I.I., assistant secretary of the Westminster Fire Office, has retired after fifty-one years' service, and has been presented with a piece of silver plate. The presentation was made by Mr. A. F. Mott, chairman of the directors.

Mr. M. J. Mortimer, A.M.I.E.E., borough electrical engineer at Loughborough, has been appointed electrical engineer and manager of the Worthing Corporation electricity undertaking in succession to the late Mr. G. Porter. The commencing salary is £1,000, rising by increments of £50 to £1,200. Mr. Mortimer received his technical training at the Central Technical Schools, Leeds, the Leeds University, and the Liverpool Technical Schools. He was apprenticed to the Midland Railway Co. at Leeds, and was afterwards employed in that company's generating stations at Bradford, Leeds and Heysham Harbour. He subsequently held appointments in the power stations of the Bury Corporation, the Mersey Railway Co., and the Yorkshire Electric Power Co. (Thornhill station). In 1918 he became station superintendent at Aylesbury, and two years later was appointed chief assistant engineer at Chelmsford. He went to Abertillery in 1921 as chief engineer and manager of the Urban District Council's undertaking and remained there until 1928, when he took up the position of borough electrical engineer at Morecambe and Heysham. He became "chief" at Loughborough in 1932.

Mr. M. J. Mortimer

Ald. J. W. Longley, chairman of the Bradford Corporation Electricity Committee, has accepted an invitation to become vice-president of the British Electrical Development Association.

Mr. D. H. Brown, A.M.I.E.E., left the Nottingham Corporation Electricity Department on December 12th to take up an appointment as assistant power station superintendent at the Thorpe electricity works, Norwich. Mr. Brown was for many years president of the Nottingham Electricity Department Cricket Club and the Nottingham Municipal Cricket League. An engraved canteen of cutlery was presented to him and Mrs. Brown at the annual carnival of the Electricity Department's team, held at the Nottingham Greyfriars Hall last month.

Mr. M. H. Volk, F.R.Ae.S., who is the eldest son of Mr. Magnus Volk, of Volk's Electric Railway (of which he is a director), informs us that he, in conjunction with Mr. S. H. Tiltman, the architect, has acted as aeronautical consultant to the Brighton, Hove and Worthing Joint Airport Committee since the inception of the scheme. The lighting at this Airport was described in our issue of December 27th.

In view of the retirement on superannuation of **Messrs. J. H. Murray** and **R. H. Shepherd,** and of the large increase in the area of supply and work of the Liverpool Electric Supply Department, a reorganisation of the staff of the Distribution Section is proposed. **Mr. C. L. Eagle** is recommended for the position of senior distribution engineer; Mr. L. Edwards to become h.p. mains engineer; Mr. D. C. McKenzie, distribution mains engineer; Mr. J. G. Jones, mains superintendent; Mr. W. C. Gorrie, mains engineer; Mr. A. E. Elsworth, mains engineer; Mr. H. B. Parkinson, assistant mains engineer; Mr. H. Dangerfield, chief distribution clerk; Mr. J. F. O'Neil, constructional engineer; and Mr. P. Ashdown, district h.p. inspector.

Obituary

Mr. A. L. Garrett.—We regret to learn that one of the passengers killed in the recent wreck of the Imperial Airways liner *City of Khartoum*, was Mr. Allan Leonard Garrett, an electrical engineer of Australian birth, who had graduated at the University of Adelaide, where he took the B.E. degree in electrical engineering. He was for two years with the Adelaide Electric Supply Co., and then, on the recommendation of Mr. F. W. H. Wheadon, managing director of the company, he went to Tyneside in 1931, at the age of twenty-three, as a Dominion student in the works and offices of Messrs. A. Reyrolle & Co., Ltd. After spending over four years at Hebburn, he left on December 27th in order to be transferred to Messrs. Reyrolle's Australian staff. While in England, Mr. Garrett had made a full technical and practical study of metal-clad switchgear, and had also interested himself in mercury-arc rectifiers, on which subject he recently read a paper before the local branch of the Junior Institution of Engineers.

The late Mr. A. L. Garrett

Mr. F. G. Downing.—The death occurred on January 2nd of Mr. F. G. Downing, of the Marconiphone Co., at the age of sixty-four. He was the oldest member of the organisation, both in years and in length of service, having been in the employ of the Sterling Telephone & Electric Co., Ltd., and the Marconiphone Co., for twenty-three years. At the time of his death he was chief of the Sales Statistics Department.

Mr. A. J. Howard.—The death occurred on January 2nd, after a short illness, of Mr. Archibald John Howard, A.M.I.E.E., aged sixty, who had been borough electrical engineer of Taunton since 1910. Mr. Howard was educated at Taunton School, and was articled to the Taunton Electric Light Co. in January, 1892, rising to be chief assistant in the Taunton Corporation Electricity Department. He later held posts at Merthyr and Leicester, and served during the Boer War. Under Mr. Howard's direction the Taunton electricity undertaking made rapid growth, particularly in recent years. About a month ago he presided at the banquet to celebrate the Jubilee of Taunton's electricity supply. The funeral took place on January 4th at St. James's Cemetery, Taunton.

The late Mr. A. J. Howard

Mr. A. J. Duncan, who has died at Melbourne, was a familiar figure in the tramway world. He began his engineering career in New Zealand in 1875, serving under his brother, the late Mr. George S. Duncan, who was engaged by the Melbourne and Metropolitan Tramways Co. to prepare designs and specifications for the Melbourne cable tramway system. From 1885 to 1887 Mr. Alfred Duncan was responsible engineer of the Cable Tramway Construction Co. of New South Wales, and under his supervision the North Shore cable tramway was constructed. In 1922 he joined the Melbourne and Metropolitan Tramways Board as assistant engineer, retiring in 1929. He became an associate member of the Institution of Civil Engineers in 1890.

Mr. Norman Mathias, for many years works superintendent at the Leeds Corporation electricity works, has died at the age of sixty-six. Mr. Mathias retired fifteen months ago.

Mr. H. W. Turner.—The death is reported in the *A.E.I. News* of Mr. Harry Winthrop Turner in Schenectady, N.Y. He was one of the pioneers who joined the American Electrical Co. in 1883 before its reorganisation as the Thomson-Houston Co. He joined the B.T.H. Co., Rugby, in 1902, and went to the Westinghouse Co., Manchester, in 1905. After other appointments on the Continent he returned to America in 1913, taking up insulation and winding problems with the American General Electric Co. Later he became associated with the research laboratory at Schenectady, from which he retired in 1932

Signor G. Gavazzi.—The death recently occurred at Bergamo, Italy, at the age of sixty-one, of Signor Giuseppe Gavazzi, a well-known Italian electrical engineer, who was responsible for the construction of a number of hydro-electric power stations in that country.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Elexcel, Ltd.—Private company. Registered January 3rd. Nominal capital, £250,000 in £1 shares (125,000 6 per cent. redeemable cumulative preference and 125,000 ordinary). Objects: To acquire the "Xcel" branch or department of the undertaking and business of Automatic Electric Co., Ltd., and all or any of the assets appertaining thereto; to carry on the business of manufacturers of and dealers in electrical and other appliances and apparatus for domestic, commercial or other purposes, and in particular all descriptions of heating, cooking and cleaning appliances and apparatus, electrical, mechanical and general engineers, &c. The first directors are: G. W. Moore, Norfolk House, Norfolk Street, W.C.2; T. A. Eades, 18, Corringham Court, N.W.11; F. C. Burstall, 1, Menlove Gardens West, Liverpool; J. Nixon, Delamere, 23, Sinclair Drive, Mossley Hill, Liverpool; A. F. Bennett, Baird Lea, Gwydrin Road, Mossley Hill, Liverpool; and J. C. Wrighton, 19, Park View Gardens, N.W.4. Solicitors: Linklaters & Paines, 2, Bond Court, Walbrook, E.C.

Aeronautical & General Instruments, Ltd.—Public company. Registered January 3rd with a nominal capital of £150,000 in 5s. shares. Objects: To acquire the goodwill, works, plant, machine tools, designs, trade marks and all other assets (except as mentioned in an agreement with Aero Syndicate, Ltd.) of the business of makers of instruments (other than wireless receiving sets and parts for home use) carried on by Radio Instruments, Ltd., of Purley Way, Croydon, and to carry on the business of instrument makers, electrical, mechanical and general engineers and contractors, manufacturers and sellers of instruments of every description, transformers, radiators, dynamos, motors and electric lighting power and transmission plant and wireless apparatus, manufacturers of and dealers in aircraft and aerodrome equipment, &c. The following are directors: Sir Louis R. Vaughan, K.C.B., K.B.E., D.S.O., 20, Evelyn Mansions, Westminster, S.W.; W. McClelland, C.B., O.B.E., M.I.E.E., White Lodge, Walton-on-Thames (director of W. T. Henley's Telegraph Works Co., Ltd.); L. V. S. Blacker, O.B.E., Coates House, near Petworth, Sussex; J. Joseph, M.I.E.E., The Beacon, Grovelands Road, Purley (director of Radio Instruments, Ltd.). Solicitors: Godden, Holme & Ward, 34, Old Jewry, E.C.

Essex Mica Co., Ltd.—Private company. Registered January 2nd. Capital, £400 in £1 shares. Objects: To carry on the business of importers, exporters, factors of and dealers in mica; and to manufacture and market electrical, scientific and general engineering accessories, &c. The directors are: R. T. Cooper, 36, Loxford Lane, Ilford, and two others. Secretary: H. H. Highsted. Registered office: 247, High Road, Ilford.

W. B. Dalrymple, Ltd.—Private company. Registered in Edinburgh December 31st. Capital, £500 in £1 shares. Objects: To carry on the business of agents, contractors, merchants, manufacturers and factors of electrical equipment and accessories, &c. The directors are: W. B. Dalrymple, 20, Lansdowne Crescent, Glasgow, and two others. Registered office: 154, St. Vincent Street, Glasgow, C.2.

Rolland Radio, Ltd.—Private company. Registered in Edinburgh December 31st. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and wholesale, retail and credit dealers in television apparatus of all kinds for use in homes or picture houses, &c. The subscribers are: E. R. Mitchell, Cruach, Bearsden, Dumbartonshire; and J. P. Glen, St. Catherines, Bearsden, Dumbartonshire. Secretary: J. P. Glen. Registered office: 2, Bridge Street, Glasgow.

Milliwatt Heating Pad, Ltd.—Private company. Registered January 2nd. Capital, £2,500 in £1 shares. Objects: To acquire the business carried on by Electric Cushions, Ltd., with the trade mark "Milliwatt," and to carry on the business of manufacturers of and dealers in electric cushions and electrical fancy and other goods, &c. The first directors are H. E. Curtis (chairman), L. V. Curtis, R. Kauffman (vice-chairman), E. R. Blaikie and E. H. Willis. Registered office: 204, Great Portland Street, W.1.

Buncrana Electric Supply Co., Ltd.—Private company. Registered in Dublin December 27th. Capital, £15,000 in £1 shares. Objects: To acquire the business of generators and suppliers of electric light, &c., now carried on by H. P. Swan and J. K. Swan as the "Buncrana Electric Supply Co." at Buncrana Town. The directors are: H. P. Swan and J. K. Swan, both of Ardarvan, Buncrana, Co. Donegal.

Trojan (Manchester), 1936, Ltd.—Private company. Registered January 1st. Capital, £1,000 in £1 shares. Objects: To carry on the business of electricians, electrical engineers and contractors, dealers in all kinds of electrical goods and accessories, radio and television goods, &c. The directors are: H. G. Jenkinson, White Lodge, Ringway, Ches.; and C. Pearce, 93, Cromwell Road, Stretford. Secretary: A. Mullock. Registered office: 13, St. Ann Street, Manchester, 2.

Marchbank & Winterbottom, Ltd.—Private company. Registered January 3rd. Capital, £1,000 in £1 shares. Objects: To acquire the business of electrical engineers and contractors as formerly carried on by Thomas G. Marchbank and Tom Winterbottom as "Marchbank & Winterbottom" at Berkeley Street, Royton, Oldham, and to carry on the business of electricians, electrical and mechanical engineers, switchgear makers, &c. The permanent directors are: T. G. Marchbank, 5, Barry Street, Royton; T. Winterbottom, 183, Block Lane, Chadderton; and I. Lumb (chairman), Domus, Dogford Road, Royton. Secretary: T. Winterbottom. Registered office: Berkeley Street, Royton, near Oldham.

Evendrawn Electric Lamp & Accessories Co., Ltd.—Private company. Registered January 2nd. Capital, £1,200 in £1 shares. Objects: To extend and carry on the business of the Evendrawn Electric Lamp and Accessories Co., of 3, Upper Woburn Place, W.C.1, and to carry on the business of manufacturers, factors and traders in electrical engineering and general products, &c. The directors are: C. D. Falcke, 16, Botolph Chambers, 119, Bishopsgate, E.C.2; W. Taylor, 3, Upper Woburn Place, W.C.1; T. Cape, Harrington Road, Workington, Cumberland; and T. S. Cornwall, Roden Street Works, Ilford. Registered office: 3, Upper Woburn Place, W.C.1.

Southern Ignition Co., Ltd.—Private company. Registered January 3rd. Capital, £1,200 in £1 shares. Objects: To acquire the business of electrical engineers and car electrical specialists carried on by Arthur S. J. Chapman (trading as Southern Ignition Company) at 161, Parchmore Road, Thornton Heath. The directors are: A. S. J. Chapman, 161, Marchmore Road, Thornton Heath; and G. J. Munson Pilgrim, 204, Melfort Road, Thornton Heath. Registered office: 161, Parchmore Road, Thornton Heath, Surrey.

Returns of Electrical Companies

Alarcal, Ltd.—A. R. King-Farlow, 34 and 36, Gresham Street, E.C., was appointed receiver on December 18th, 1935, under powers contained in debenture dated October 8th, 1935.

Wessex Engineering Co., Ltd.—Hemsley C. E. Miller, 18, Mackenzie Street, Slough, ceased to act as receiver and/or manager on December 20th, 1935.

Evershed & Vignoles, Ltd.—The nominal capital has been increased by the addition of £40,000 beyond the registered capital of £80,000. The additional capital is divided into 40,000 6 per cent. non-cumulative preference shares of £1.

Bristol Tramways and Carriage Co., Ltd.—The nominal capital has been increased by the addition of £500,000 in £1 ordinary shares beyond the registered capital of £1,500,000.

Radio Rentals, Ltd.—The nominal capital has been increased by the addition of £10,000 beyond the registered capital of £20,000. The additional capital is divided into 25,000 ordinary shares of 4s. and 5,000 cumulative preference shares of £1.

Splendor Lamp Co., Ltd.—Debenture dated December 18th, 1935, to secure £10,000 charged on freehold land, buildings and premises in Morden Road, Merton, Surrey, and the company's undertaking and other property, present and future, including uncalled capital. Holders: Westminster Bank, Ltd.

Gambrells, Rowse & Snoaden, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 10th, 1935, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Berkeley and Young, Ltd.—Debenture dated December 4th, 1935, to secure £17,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: N. W. Gilbert, "Waimarino," Warwick Road, Solihull, Warwickshire.

Gray Electrical Motors, Ltd. (formerly Invicta Vacuum Cleaners, Ltd.).—Debenture dated December 14th, 1935, to

secure £550 charged on the company's property, present and future, including uncalled capital. Holder: A. W. Scott, 7, Staple Inn, Holborn, W.C.

W. J. Creemer, Ltd.—Debenture dated December 18th, 1935, to secure £3,500 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Atherton Wireless Relay Co., Ltd.—Capital, £200 in £1 shares. Return dated October 4th, 1934 (filed June 20th, 1935). 200 shares taken up. £200 paid. Mortgages and charges, nil.

North Lincolnshire and Howdenshire Electricity Co., Ltd.—Capital, £250,000 in £1 shares. Return dated April 30th, 1935. 99,007 shares taken up. £99,007 paid. Mortgages and charges, nil. A further 110,809 shares (91,000 for cash and 19,809 as fully paid) were allotted between October 15th and November 26th, 1935.

Express Radio Factors, Ltd.—Capital, £2,500 in £1 shares. Return dated September 23rd, 1935. All shares taken up. £2,500 paid. Mortgages and charges, nil.

Warner's Radio & Electric, Ltd.—The nominal capital has been increased by the addition of £119,900 beyond the registered capital of £100. The additional capital is divided into 120,000 6 per cent. cumulative preference shares of 10s. and 1,198,000 ordinary shares of 1s.

Burslem's Patents, Ltd.—Issue on December 23rd, 1935, of £1,000 debentures, part of a series already registered.

Herne Bay & District Electricity Supply Co., Ltd.—Issue on December 10th, 1935, of £7,000 debentures, part of a series already registered.

Taylor's Radio Service, Ltd.—Issue on December 14th, 1935, of £300 debentures, part of a series already registered.

Silver Fox Electrical Co., Ltd. (in liquidation).—Satisfaction to the extent of £30,000, on December 21st, 1935, of first debentures authorised April 26th, 1934, and registered May 3rd, 1934.

Dundas Fox, Ltd. (in liquidation).—Satisfaction on December 21st, 1935, to the extent of (1) £20,000 of first debentures, authorised April 26th, 1934, and registered May 3rd, 1934, and (2) £6,000 of the second debentures authorised June 8th, 1934, and registered June 21st, 1934.

Whitaker Electric Co., Ltd.—H. Rule, of Bush Lane House, Cannon Street, London, E.C., was appointed receiver and manager on December 24th, 1935, under powers contained in debenture dated January 5th, 1935.

Oriental Telephone & Electric Co., Ltd.—Satisfaction to the extent of £900, on December 10th, 1935, of debenture stock secured by trust deed dated June 28th, 1905, and a supplemental deed of acknowledgment dated June 12th, 1907, and registered July 11th, 1905 and June 20th, 1907, respectively.

W. E. Amies & Co., Ltd.—The nominal capital has been increased by the addition of £5,000, beyond the registered capital of £7,000. The additional capital is divided into 5,000 6 per cent. cumulative preference shares of £1 each.

Merthyr Radio Central Exchange, Ltd.—Capital, £10,000 in 8,500 preference shares of £1 and 30,000 ordinary shares of 1s. Return dated October 3rd, 1935. 5,500 preference and 30,000 ordinary shares taken up. £5,450 2s. paid on 5,450 preference and two ordinary shares, £1,549 18s. considered as paid on fifty preference and 29,998 ordinary shares. Mortgages and charges nil.

Domestic Electrification, Ltd.—Capital, £50,000 in £1 shares. Return dated October 18th, 1935. 40,000 shares taken up. £40,000 paid. Mortgages and charges nil.

Mersey Cable Works, Ltd.—Capital, £40,000 in 10,000 preference and 30,000 ordinary shares of £1. Return dated October 4th, 1935. 9,400 preference and 22,000 ordinary shares taken up. £31,400 paid. Mortgages and charges nil.

S. Dickinson, Ltd.—Capital, £1,000 in £1 shares. Return dated October 14th 1,935. 645 shares taken up. £645 considered as paid. Mortgages and charges nil.

Van Raden & Co., Ltd.—Capital, £10,000 in £1 shares. Return dated October 30th, 1935. 6,754 shares taken up. £4,654 paid, £2,100 considered as paid. Mortgages and charges nil.

City Notes

Bullers, Ltd., show a balance upon trading account of £30,782 for the year ended July 31st, 1935, after deducting taxation, &c., which with interest, dividends and transfer fees of £899, makes £31,681. After deducting depreciation and debenture interest there is a profit of £16,153, as against a loss in the preceding year of £2,590. From this is deducted a debit balance of £2,392 brought in, and after paying a dividend of 3½ per cent. on the preference shares on account of arrears outstanding since January 31st, 1933, a balance of £8,511 is carried forward. The report states that further extensions will be needed in the current year, but the expenditure involved should be amply justified by an increased demand for the company's products. Trading conditions in the home market have decidedly improved, but export trade is still hampered by exchange and other difficulties, in addition to which the changing conditions of the electrical industry and keen competition necessitate constant research and expenditure to keep up with new developments.

The North Metropolitan Electric Power Supply Co.—The Bill to confer further powers on this company, to which we have already briefly referred, provides for the increasing of the capital from £5,000,000 to £8,000,000 and the borrowing on the £3,000,000 new capital a further £1,500,000 in addition to the present loan capital. It also provides that any part of the unissued capital may be raised by the issue of first preference shares or stock ranking *pari passu* with the existing 6 per cent. cumulative preference stock. The Bill further empowers the London Passenger Transport Board to sell or lease to the company the Neasden generating station and provision is made to enable the company to incur temporary loans not exceeding £1,500,000.

The Adelaide Electric Supply Co., Ltd., reports a gross revenue for the year ended August 31st last of £824,344, as compared with £787,728 in 1933-34. Operating expenses, including taxes, took £407,329, leaving a net revenue of £417,015 (against 432,419). After providing for debenture interest, &c., the net profit was £362,491 (£379,095), from which £93,643 has been placed to reserve, £2,500 to dividend equalisation account, and £20,000 to contingency reserve. The ordinary dividend is maintained at 10 per cent., the final distribution of 5 per cent. being payable on the capital as increased by a 25 per cent. bonus issue made last May. The amount carried forward is raised by £17,598 to £109,602. The directors state that a reduction in tariffs, amounting to £53,000 per annum, came into force on January 1st, 1934, and further reductions, estimated at £30,000 per annum, were made as from January 1st, 1935.

Companies Struck Off the Register.—The names of the following companies have been struck off the Register and they are thereby dissolved :—Bevan's Radio Supplies, Ltd.; British Electrical Industries (Birmingham), Ltd.; Central Radio Agencies, Ltd.; Cyntra Electric Supplies, Ltd.; Electro-Medical Circulators, Ltd.; Electro-Medical Lamps & Neon, Ltd.; H. & C. Wireless, Ltd.; Homeaids Ambilectric Radio, Ltd.; Hurtons (Electrical), Ltd.; Invicta Radio, Ltd.; Manor Electric, Ltd.; Modern Electric (Manchester), Ltd.; Page Car Radio, Ltd.; Radio Maintenance, Ltd.; Radio Mutual, Ltd.; Sidcup Electrical Co., Ltd.; Wholesale Radio Supplies, Ltd.

International Combustion, Ltd., declares a profit for the year to September 30th last of £114,800 plus £51,667 reserves created on contracts completed prior to the current year no longer required, making £166,467 which is supplemented by £5,664 brought in. Directors' fees absorb £1,900, income tax £15,700, and the 20 per cent. ordinary dividend £70,340. Reserve takes £50,000 and £25,192 is carried forward. The report states that business continues to expand in all departments.

Thomas Bolton & Sons, Ltd., have announced an interim dividend of 2½ per cent. on the ordinary shares (same).

Stocks and Shares

TUESDAY EVENING.

THE first weeks of the New Year have opened in satisfactory fashion for the investor, nor has the speculator been left out in the general improvement which has taken place in the markets round the House. With the turn of the year, a good deal of the money which was being held back for window-dressing purposes, has been released for employment in, more particularly, the gilt-edged markets, and those which deal with industrial shares. It may be said, indeed, that the industrial sections are more animated to-day than they have been for some time past, to which it may be only fair to add the qualification that the activity is somewhat selective—to use a popular word—as well as being spasmodic. This week's price lists show few material changes outside the group of those connected with shares in the manufacturing and equipment companies. In the latter, the upward progress has been rapid in several cases. The improvements noted in our tables are four times as many as the declines.

Debenture Stocks as Investments

Notwithstanding the scarcity of supply of sound investments, and the difficulty that prevails of obtaining what may be called a living rate of yield from the purchase of Stock Exchange securities, there can be obtained various debenture stocks that afford an income ranging from 3¼ per cent. to nearly 4 per cent. on the money, without allowing for redemption. This latter clause is, of course, of paramount consideration in respect of stocks that stand at a high premium. The prospective buyer should on no account neglect to make full inquiries as to a company's right to repay stock should he decide to put money into redeemable debenture securities. Where the price of the stock stands within a point or two of par, or of the redemption price, the risk of repayment-loss is, of course, comparatively slight. Moreover, several of the good insurance companies will, for a small premium, guarantee a stockholder against possible loss that may be incurred by repayment of his stock. Such insurance is, as a rule, worth while the undertaking, as many holders of 4 per cent. Victory Bonds, for example, have found.

Securities on Offer

A thousand pounds or so of City of London Electric 5 per cent. first debenture stock, with January and July interest, is on offer at 127, ex the interest recently paid. This gives £3 18s. 6d. per cent. and is a gilt-edged security. It can be paid off by the company at 125, at any time upon six months' notice. London Power 4 per cent. redeemable debenture stock can be bought at 110 to yield £3 12s. 9d. per cent. Repayment can start at any time after 1952 at 100. Edmundson's 4 per cent. debenture at 105 gives £3 16s. per cent. Midland Counties Electric 4 per cent. debenture at 107½, pays £3 14s. per cent. The Edmundson's debenture can be paid off by the company at any time after 1950 at 100. The Midland Counties Company has various options in regard to redemption of the stock mentioned. Between the end of 1936 and 1947, the stock can be repaid at 103; thereafter, at 102. Final redemption at 100 must be effected in 1962. St. James' and Pall Mall 3½ per cent. debenture at 102½ x.d. gives £3 8s. 3d., and this can be repaid at 100 at any time with six months' notice. There is £25,000 North Metropolitan Electric Power Supply 3¼ per cent. debenture stock available at 101, free of stamp and fee. The

first payment of interest is due on July 1st next, and at the present price the return is £3 4s. per cent. on the money.

Electricity Supply Shares

The rise of 1s. in the shares of London Associated Electrics, to 36s., gives the cue to the disposition of this market as a whole. On the basis of the probable 7 per cent. dividend—some people expect it to be more—the yield is only £3 17s. 9d. per cent., eloquent witness to the respect which the shares of the London electricity supply companies command in the eyes of investment. County of London ordinary are a florin up, at 56s.

Scottish and Provincial descriptions display an almost equal measure of strength. Clyde Valley shares are 1s. 6d. higher at 46s. The shares in both the Yorkshire companies have improved. North-Eastern ordinary lost 6d., but the preference gained it. Edmundsons are 1s. better at 44s. 6d.

Perak Hydro-Electrics have jumped to 24s., and Palestine "A" to 54s. The Indian list shows an advance in Calcuttas to 62s. 6d. Buying of Atlas has lifted the price to 6s. 9d. British Power shares are 30s. 3d.

Cable and Wireless

In the Cable and Wireless trio, the only quotable change is a rise of ¾ in the "A" ordinary stock. The preferred can be bought at 106. Both classes of Globe Telegraphs are easier, the ordinary at 15¼, the 6 per cent. preference at 14¼. Upon inquiry from New York, American Telephone and Telegraph proved to be in somewhat scanty supply, and, in reflection of this, the price is 5½ up at 160½. Internationals at 14 are attracting a little speculative interest. President Roosevelt has not increased the popularity of his policy by his latest announcements, but political crisis in Washington has done nothing to check the increasing readiness of the American public to accumulate the shares of their utility companies.

Cromptons and Enfield Rolling Mills

Two of the outstanding features of the moment are Crompton Parkinson shares and Enfield Rolling Mills. Cromptons are now split. The capital having been doubled, the price of the shares in the market was halved, and, in its new form, the quotations started at 64s., equal, roughly, to 128s. for the old shares. Within a very short time the price was up to 70s., which is equal, also approximately, to £7 for the old shares. Those who have been following the course of the market are convinced that this time next year the price will be standing even higher than it does to-day. At the same time, they admit that 70s. is a fairly high figure for the shares, as things now stand. In consequence there has been no little profit-taking on the part of people who got in very much lower down.

Enfield Rolling Mills, which had been for months past a very poor market round about 20s., have suddenly spurted to the neighbourhood of 28s. The recent report started the upward movement, and the issue of new shares at 20s. 6d., instead of proving a drag upon the price, gave encouragement to fresh buyers. The expectation of a cheerful speech from the chairman at the annual meeting added strength to the market. The new shares rose to 7s. 3d. premium above the issue price of 20s. 6d. From being dull and neglected, the shares have abruptly changed round into a popular speculative investment. The impression prevails that with shares in other electrical equipment companies standing at such substantial premiums as most of them do, investment will be ready to pay anything under 30s. for Enfield Rolling Mills, in view of the prospects for the company, and the backing which it possesses. Enfield Cable ordinary shares are unchanged at 5½.

Manufacturing and Equipment

Associated Electrical Industries ordinary hardened to 44s.; English Electrics have been a good spot with a rise of nearly ½, and General Electric ordinary at 74s. 6d. are 1/6 higher. No recovery has occurred in the price of Aron shares, which remain at 55s. Ericssons have gone back to 36s. 3d., losing the advantage which they gained a week ago. International Automatic Telephone ordinary shares at 45s. and the B at 43s. 6d. are both better on balance. Hall Telephone Accessories at 23s. 6d. are slightly higher. At 9s. 3d., Telephone Rentals are ex dividend. Johnson & Phillips new ordinary at 49s. 6d. have come into line with their senior shares. Brush ordinary stock, after its spurt to 50, relapsed into depression, receding to 47½. Business in this section of the Industrial market is very animated.

Miscellaneous Matters

British Electric Traction deferred is up 100 points at 1,600. Contrary to what might be expected in a market like this, there is a good deal of business done every day in the stock. People are content to deal at prices with a margin of, roughly speaking, 15 points between selling and buying. The iron and steel market is more confident. Babcock & Wilcox, in sympathy, advanced to 53s. The rubber market has taken a turn, albeit a very timid one, for the better.

London Passenger Transport "C" at 109 is a good spot. The gilt-edged market shows decided strength. It is strictly correct, in fact, to say that in the majority of the investment stocks and shares, quoted in our lists this week, the prices represent figures at which the securities can be sold much more easily than they can be bought.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend 1933.	Dividend 1934.	Price Jan. 7	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	3⅝	—	3 17 5
City of London	1	7½	7½	37/–	—	4 1 0
Clyde Valley	1	7	8	46/–	+1/6	3 9 7
County of London	1	10½	10½	56/–	+2/–	3 15 0
Edmundson's 7% Pref.	1	7	7	36/–	—	3•17 9
Do. Ord.	1	7	8	44/6	+1/–	3 12 0
Elec. Dis. Yorkshire	1	9	9	47/–	+1/–	3 16 7
Elec. Fin. and Securities	1	12½	12½	3 7/16	—	3 12 9
Elec. Supply Corporation	1	11	11	3⅛	—	3 10 3
Lancs Light and Power	1	7½	7½	38/–	—	3 19 0
Lond. Assoc. Electric	1	—	—	36/–	+1/–	3 17 9
London Electric	1	7	8	39/6	+6d.	4 1 0
London Power Deb. Red.	Stock	5	5	109½	—	4 11 4
Metropolitan	1	10	10	52/–	—	3 17 0
Midland Counties	1	7	7	2	+1/–	3 10 0
Mid. Elec. Power	1	8	8	41/3	—	3 17 6
North Eastern Electric Ordinary	1	6	6	33/6	–6d.	3 11 7
Do. 7% Pref.	1	7	7	35/6	+6d.	3 19 0
Northampton	1	10	10	51/3	—	3 18 0
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	57/6	—	3 9 5
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	42/6	—	3 15 3
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	46/–	+1/–	3 9 7

PUBLIC BOARDS.

Central Electricity 1950–70	Stock	5	5	117	+½	4 5 6
Do. 1955–75	,,	5	5	119½	—	4 3 8
Do. 1951–73	,,	4½	4½	111	—	4 1 1
Do. 1963–93	,,	—	3½	106	+2	3 6 0
London Elec. Trans. Gtd.	,,	—	2½	97	—	2 11 8
London & Home Counties, 1955–75	,,	4½	4½	112xd.	—	4 0 4
London Passenger Transport, A	,,	—	4½	124	+1½	3 12 9
Do. do. B	,,	—	5	128½	—	3 17 10
Do. do. C	,,	3½	4	109	+1	3 13 5
West Midlands Joint Elec. 1948–68	,,	—	5	116½	—	4 5 10

TELEGRAPH AND TELEPHONE.

American Tel. & Tel.	$100	9	9	160½	+5½	5 12 2
Anglo-Am. Tel. Pref.	Stock	6	6	124½	—	4 16 5
Do. Def.	,,	1½	1½	31	—	4 16 10
Cable & Wireless 5½% Pref.	,,	2¾	4½	106	—	3 17 10
Do. A. 7½% Ord.	,,	Nil	Nil	29½	+⅜	—
Do. B. Ord.	,,	Nil	Nil	8	—	—
Globe Tel. & Tel. Ord.	10	2½	3½*	15½	–½	2 6 0
Do. do. Pref.	10	6	6	14½	–⅛	4 3 6
Great Northern Tel.	10	20	20	40	—	5 0 0
Marconi-Marine	1	10	7½	36/3	—	4 2 9
Oriental Telephone Ord.	1	12	12	3½	—	•3 16 10

HOME AND FOREIGN TRAMS, ETC.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1600	+100	—
Do. do. Pref. Ord.	,,	8	8	173½	—	4 12 3
Brazil Traction	100	—	—	10	—	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	100½xd.	+4	4 19 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	3	—	—
Do. 1st Bonds	$500	5	5	50	—	—
Victoria Falls Ord.	1	20	20	3⅜	—	—
West Riding	1	5	6½	47/6	—	2 14 9

MANUFACTURING COMPANIES.

Aron Electricity Ord.	1	10	15	55/–	—	5 9 0
Assoc. Elec. Ord.	1	4	6	44/–	+1/–	2 14 7
Do. Pref.	1	8	8	39/–	+6d.	4 2 1
Babcock & Wilcox	1	6	8	53/–	+9d.	3 0 6
British Aluminium Ord.	1	5	7½	43/9	—	3 8 6
British Insulated Ord.	1	5	15	5	—	3 0 0
Brush Ord.	Stock	Nil	Nil	47½	–1½	—
Callender's	1	15	15	3⅜	—	3 17 5
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord.	5/–	—	12½	70	+⅜	0 8 6
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref.	1	7½	7½	27/6	—	5 9 0
Electric Construction	1	Nil	3½	32/6	—	2 3 1
Enfield Cable Ord.	1	25	25	5½	—	4 10 10
English Electric	1	Nil	Nil	22/9	+2/9	—
Do. do. Pref.	1	Nil	Nil	24/6	+6d.	—
Ericssons Tel.	5/–	—	24	36/3	–¼	—
Ever Ready	5/–	35	35	24/6	—	7 2 10
Ferranti Pref.	1	7	7	27/3	—	5 2 9
G.E.C. Pref.	1	6½	6½	33/–	—	3 18 9
Do. Ord.	1	8	10	74/6	+1/6	2 13 10
Henlys	1	30	30	7 1/16	—	4 5 0
Do. 4½% Pref.	5	4½	4½	5⅝	—	3 16 8
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	5	7½	49/6	+9d.	3 0 6
Siemens Ord.	1	6½	4	26/3	—	3 1 0
Telegraph Construction	£1	Nil	Nil	25/–	—	—

• Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1934

7266. "Electric ship-propulsion systems." General Electric Co., Ltd., G. Ellis, and C. W. Saunders. March 7th, 1934. (439736.)

3631. "Acoustic reproducers." Marconi's Wireless Telegraph Co., Ltd. March 17th, 1933. (439561.)

10683. "Television, picture telegraphy, and the like." L. Seniff. April 9th, 1934. (439737.)

11436. "Vapour electric-discharge devices." British Thomson-Houston Co., Ltd., and General Electric Co., Ltd. April 15th, 1933. (Addition to 414391.) (439801.)

16047. "Alternating-current apparatus." F. J. Cleveland. (General Radio Co.) May 29th, 1934. (Convention date not granted.) (439567.)

16464. "Electric cooking stoves." G. H. Collins and H. F. Collins. June 2nd, 1934. (439571.)

16780. "Switchgear specially applicable to motor starters." F. B. Cox. June 6th, 1934. (439573.)

16907. "Electric cable installations." Callender's Cable & Construction Co., Ltd., L. G. Brazier and D. M. Robinson. June 7th, 1934. (439575.)

17248. "Deflecting systems for cathode-ray tubes." A. C. Cossor, Ltd. June 12th, 1933. (439636.)

17399. "Draw-out type electric switchgear." British Thomson-Houston Co., Ltd., and E. D. Regis. June 12th, 1934. (439690.)

17624. "Electric tests or measurements and apparatus therefor." Standard Telephones & Cables, Ltd., J. Collard, R. L. Hughes and K. E. Latimer. June 14th, 1934. (439808.)

17659. "Electrical time base circuit arrangements." Marconi's Wireless Telegraph Co., Ltd., and R. J. Kemp. June 14th, 1934. (439813.)

17765. "Methods of mounting electric motors." British Thomson-Houston Co., Ltd., and A. G. Salisbury. June 15th, 1934. (439817.)

17768. "Means for superposing currents of musical or high frequencies on electrical distribution networks for signalling or for tele-control." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. June 22nd, 1933. (439818.)

17814. "Manufacture of storage battery plates." Y. Tachihara. August 9th, 1933. (439822.)

17884. "X-ray photographic apparatus." A. Hilger, Ltd., R. L. Smith and F. Twyman. June 16th, 1934. (Cognate application 22797/34.) (439827.)

17888. "Electric-discharge lamps." British Thomson-Houston Co., Ltd., and W. J. Scott. June 16th, 1934. (439829.)

17901. "Insulated electric conductors." Associated Electric Laboratories, Inc. July 5th, 1933. (439831.)

18092. "Start-stop telegraph systems." R. G. Griffith. June 19th, 1933. (Cognate application 32521/34.) (439745.)

18198. "Electric cables." W. T. Henley's Telegraph Works Co., Ltd., and P. Dunsheath. June 20th, 1934. (439836.)

18234. "Contact mechanisms for controlling electric circuits." J. G. Smithson and J. G. Smithson and Co., Ltd. June 20th, 1934. (439641.).

18314. "Protectors for flexible electric cables." G. H. Collins and H. F. Collins. June 21st, 1934. (439642.)

18543. "Electric-arc atomic hydrogen heating torches." A. L. Guest and Associated Electrical Industries, Ltd. June 22nd, 1934. (439644.)

18858. "Carrier-current signalling systems." P. P. Eckersley and R. E. H. Carpenter. June 26th, 1934. (439747.)

20262. "Photo-telegraphic, telekinematographic, television, and like systems." A. G. D. West, and Baird Television, Ltd. July 10th, 1934. (439579.)

22554. "Plug-and-socket connectors for electrical circuits." A. P. Lundberg & Sons, Ltd., and G. Pegg. August 2nd, 1934. (439841.)

22600. "Electric starting systems for internal-combustion engines." W. Geipel, Ltd., and W. Guy-Pell. August 2nd, 1934. (439750.)

22647. "Television or like systems." L. R. Merdler and Baird Television, Ltd. August 3rd, 1934. (439652.)

23794. "Telephone repeaters." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). August 17th, 1934. (439752.)

23877. "Electric circuit-breakers." British Thomson-Houston Co., Ltd. August 19th, 1933. (439653.)

24467. "Thermionic-valve arrangements." J. Greig. August 24th, 1934. (439755.)

25412. "Cycle lamps of the electric dry-battery type." F. J. Miller. September 4th, 1934. (439704.)

25597. "Electric circuit-breakers." British Thomson-Houston Co., Ltd. September 7th, 1933. (439757.)

26121. "Combined on or off indicator and overload protective systems for electric switchgear." A. Sadler (Schiele & Bruchsaler Industriewerke Akt.-Ges.). September 12th, 1934. (439655.)

26734. "Electric plug couplings combined with switches." R. T. Waite. September 18th, 1934. (439760.)

26910. "Interlocking devices for electric switches." Midland Electric Manufacturing Co., Ltd., and A. W. Vicary. September 19th, 1934. (439761.)

27632. "Electric converting apparatus." British Thomson-Houston Co., Ltd. September 26th, 1933. (439762.)

27737. "Methods of recording acoustic vibrations." British Thomson-Houston Co., Ltd. September 29th, 1933. (439710.)

28434. "Entry arrangement for electric cables to joint boxes and other structures." British Insulated Cables, Ltd., and R. W. Blades. October 4th, 1934. (439712.)

28695. "Electrical resistance welding machines and automatic control therefor." L. Mellersh-Jackson (American Chain Co., Inc.) October 6th, 1934. (439586.)

29088. "Direction-finding apparatus for use in wireless telegraphy." R. H. L. Bevan and C. Crampton. October 11th, 1934. (439714.)

29571. "Impulse transmitters for automatic telephone systems." Siemens Bros. and Co., Ltd., and E. H. Riber. October 16th, 1934. (439715.)

29984. "Protective arrangements for electric systems employing a power transformer with distributed windings." British Thomson-Houston Co., Ltd. October 19th, 1933. (439716.)

30635. "Induction furnace with an open iron yoke." Siemens & Halske Akt.-Ges. February 6th, 1934. (439590.)

32666. "Electric measuring instruments." J. Miyazaki. November 13th, 1934. (439659.)

34092. "Electric lamps, electric-discharge devices and like devices, having an energy-translating element in a sealed bulb." British Thomson-Houston Co., Ltd. November 29th, 1933. (439593.)

34613. "Electric hand-lamps." O. Janzen. December 15th, 1933. (439724.)

37197. "Method of testing voltage transformers." W. Hohle. December 30th, 1933. (439661.)

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1140. "Earthing of tumbler switches." A. P. Lundberg & Sons, Ltd., and G. Pegg. January 12th, 1935. (439600.)

2315. "Electrically heated water-circulators." W. C. Gee and W. E. Mercer. January 24th, 1935. (439601.)

2517. "Orthoscopic diaphragms for Röntgen-ray working." Siemens-Reiniger-Werke Akt.-Ges. February 5th, 1934. (Cognate application 2518/35.) (439728.)

3625. "Control systems for electric-discharge apparatus." Siemens-Schuckertwerke Akt.-Ges. February 3rd, 1934. (Addition to 423535.) (439729.)

4505. "Boundary beacon light for air ports." E. Curran. February 12th, 1935. (439730.)

4689. "Television or like systems." J. L. Baird and Baird Television, Ltd. (September 25th, 1934.) (Divided out of 26344/33.) (439771.)

6647. "Wound condenser and method of manufacturing the same." Electrische Gluhlampenfabriken J. Kremenezky Akt.-Ges. March 2nd, 1934. (439665.)

8392. "Photo-electric cells and methods of manufacturing the same." British Thomson-Houston Co., Ltd. March 21st, 1934. (439774.)

8732. "Radio energy reflectors." Telefunken Ges. für Drahtlose Telegraphie. March 21st, 1934. (439608.)

10868. "Telephone and telegraph signalling systems." E. E. Kleinschmidt. April 14th, 1934. (439778.)

11056. "Caps for incandescent electric lamps." Ensign Lamps, Ltd., C. H. Bradshaw and A. J. Sedwell. April 10th, 1935. (439612.)

12863. "Electric water heaters." L. P. Haussauer. April 30th, 1935. (439615.)

15497. "Electrolytes for use in electrolytic condensers." F. C. Stephan and the Telegraph Condenser Co., Ltd. May 28th, 1935. (439788.)

15802. "Method of manufacturing electrodes for electrolytic condensers." S. G. S. Dicker (Naamlooze Vennootschap Maatschappij tot Exploitatie van Uitvindingen). September 26th, 1934. (Divided out of 27624/34.) (439789.)

16468. "Grid electrode for electron tubes." Egyesult Izzolampa Es Villamossagi Reszvennetarsasag. June 6th, 1934. (439792.)

18025. "Automatic control systems for electric motors." P. W. Forrest. June 24th, 1935. (439672.)

19565. "Magnetos." J. Bernard. July 24th, 1934. (Cognate application 19566/35.) (439849.)

22522. "Electrode structures for electron-discharge devices." Standard Telephones & Cables, Ltd. November 1st, 1934. (439851.)

22798. "Valves used in wireless sets." C. Lorenz Akt.-Ges. August 21st, 1934. (439852.)

24320. "Electric overload protective systems and apparatus therefor." G. R. Shepherd (Westinghouse Electric & Manufacturing Co.). August 30th, 1935. (439853.)

25876. "Method and arrangement for wireless television transmission." Radioakt.-Ges., D. S. Loewe. March 11th, 1933. (Divided out of 7730/34.) (Addition to 436142.) (439734.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 2nd:—

OFHC (lettering and design). No. 551711. Class 5. Copper wire, &c.—American Metal Co., Ltd., New York, U.S.A. (British representatives: Forrester, Ketley & Co., Jessel Chambers, 88-90, Chancery Lane, W.C.2.)

Ace. No. 563704. Class 6. Electrical machinery and parts thereof for driving sewing machines, &c.—James Cook & Sons, 126, Aldersgate Street, E.C.1.

Columbus. No. 561587. Class 8. Electrical time switches.—Elkay Electrical Manufacturing Co., Ltd., 4, Southampton Row, W.C.1.

Libraphone. No. 563249. Class 8. Sound recording and reproducing apparatus.—T. O. Leefe, 403, Harborne Road, Edgbaston, Birmingham.

Raydyot. No. 564125. Class 13. Cleats, clips, and clamps for cables, inspection lamps, switch clips, switches, lampholders, plugs and socket connections, &c.—James Neale & Sons, Ltd., 68, Graham Street, Birmingham.

Heatrae. No. 560275. Class 18. Electrically heated hot-water storage apparatus.—Heatrae, Ltd., Heatrae Works, St. George's Street, Norwich.

Micaloid. No. 561598. Class 50. Mouldable material in sheet form composed of mica and cement, the mica predominating, and electric insulators moulded from such material.—Mica Manufacturing Co., Ltd., 216-8, Homesdale Road, Bromley, Kent.